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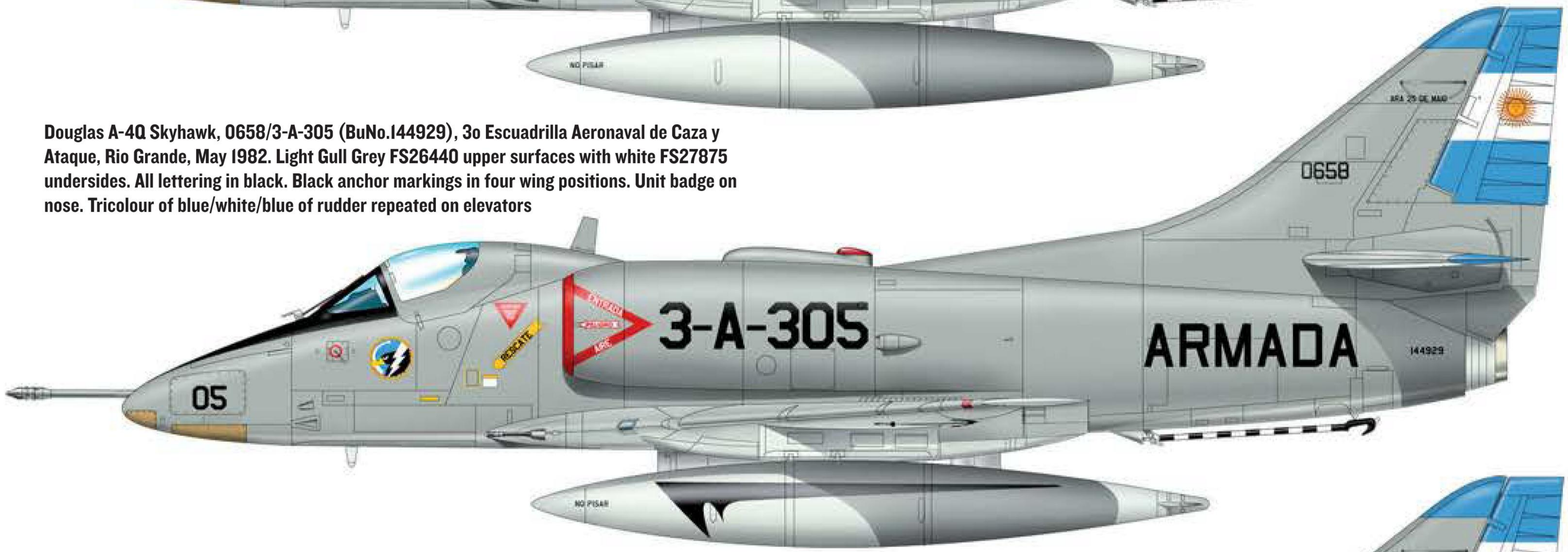
Douglas A-4Q Skyhawk, 0669/A-216 (BuNo.145061), Base Aeronaval Comandante Espor, October 1972. Light Gull Grey FS26440 upper surfaces with white FS.27875 undersides. All lettering in black. Black anchor markings in four wing positions. Tricolor of blue/white/blue of rudder repeated on elevators

Douglas A-4Q Skyhawk, 0658/3-A-305 (BuNo.144929), 3o Escuadrilla Aeronaval de Caza y Ataque, Rio Grande, May 1982. Light Gull Grey FS26440 upper surfaces with white FS27875 undersides. All lettering in black. Black anchor markings in four wing positions. Unit badge on nose. Tricolour of blue/white/blue of rudder repeated on elevators

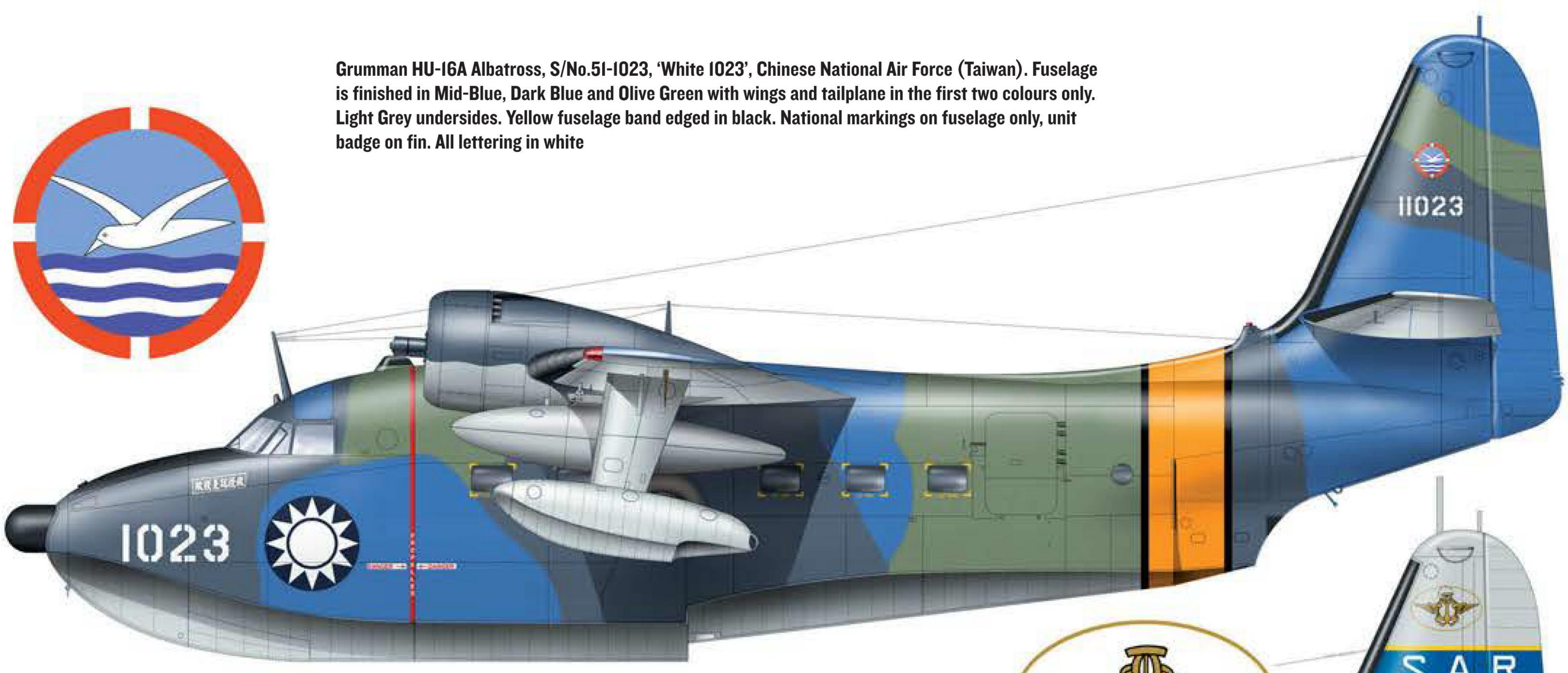


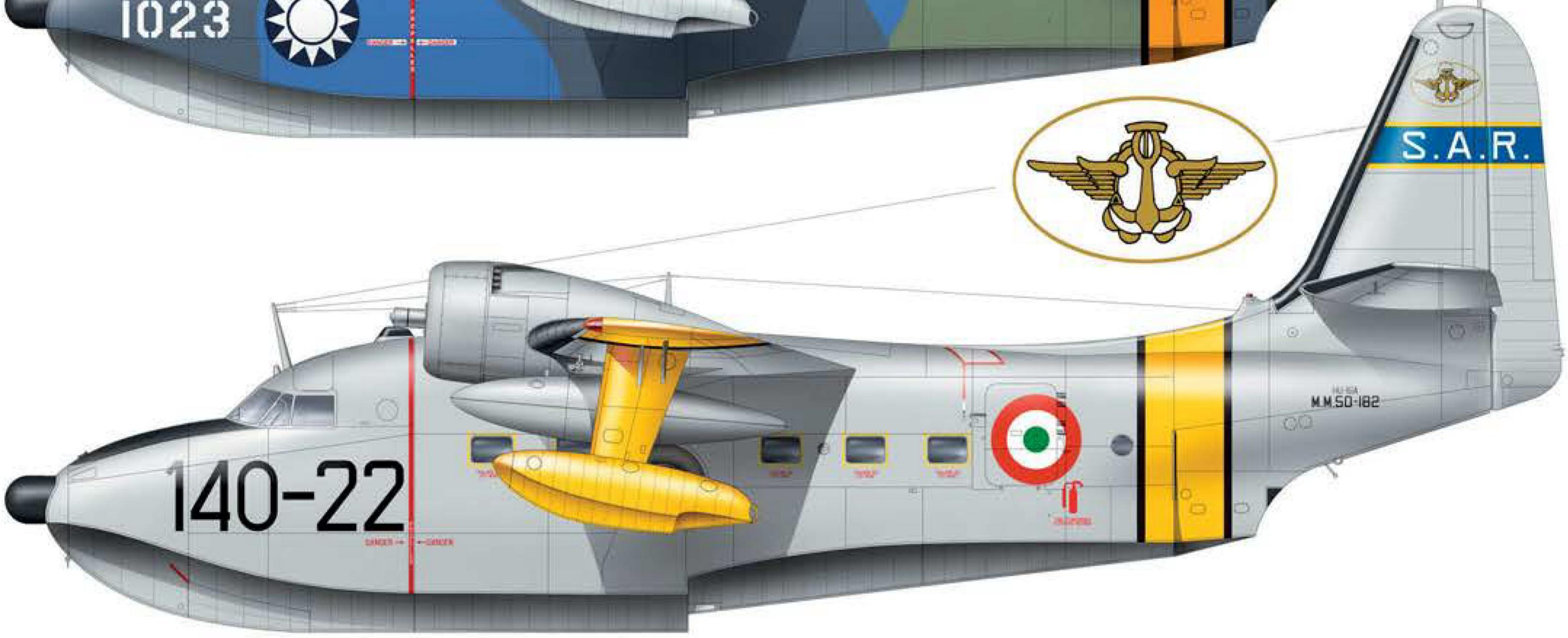
Douglas A-4Q Skyhawk, 0668/3-A-215 (BuNo.145053), 3o Escuadrilla Aeronaval de Caza y Ataque, Rio Grande, May 1982. Light Gull Grey FS26440 upper surfaces with white FS27875 undersides. All lettering in black. Black anchor markings in four wing positions. Tricolour of blue/white/blue of rudder repeated on elevators

Douglas A-4Q Skyhawk, 0657/3-A-304 (BuNo.144915), 3o Escuadrilla Aeronaval de Caza y Ataque, Rio Grande, May 1982. Brown and green camouflage on upper surfaces with undersides retaining original white FS27875. Lettering in black. Unit badge on port side of nose only. National flag on fin. Tricolour elevators retained

Douglas A-4Q Skyhawk, 0656/3-A-302 (BuNo.144882), 3o Escuadrilla Aeronaval de Caza y Ataque, Base Aeronaval Comandante Espora, 1984. Early low-viz finish adopted on the A-4Qs consisting of green upper surfaces with undersides retaining the original white FS27875. All lettering and markings on upper surfaces in light green. Black anchor markings in four wing positions. Unit badge on nose. Tricolour of blue/ white/blue of rudder repeated on elevators. National flag on fin

Grumman HU-16A Albatross, S/No.51-1023, 'White 1023', Chinese National Air Force (Taiwan). Fuselage is finished in Mid-Blue, Dark Blue and Olive Green with wings and tailplane in the first two colours only. Light Grey undersides. Yellow fuselage band edged in black. National markings on fuselage only, unit badge on fin. All lettering in white

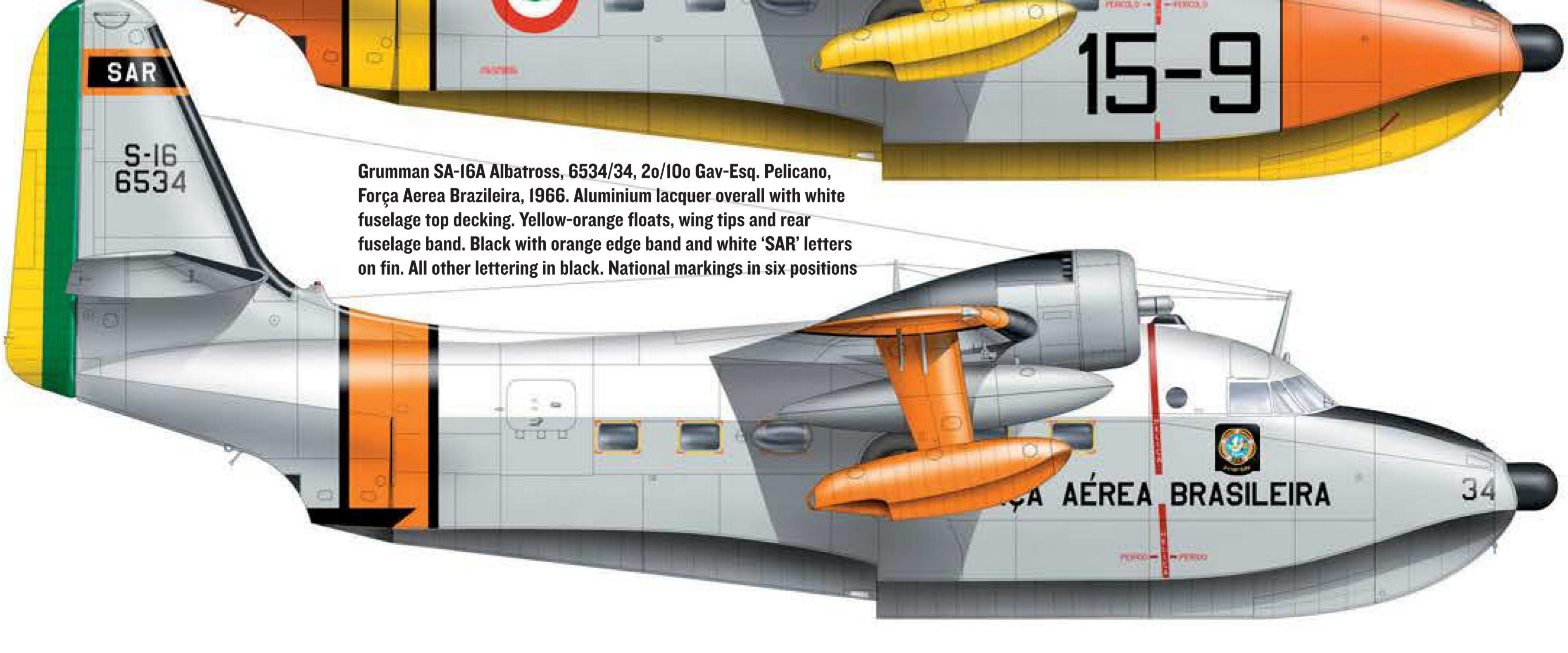




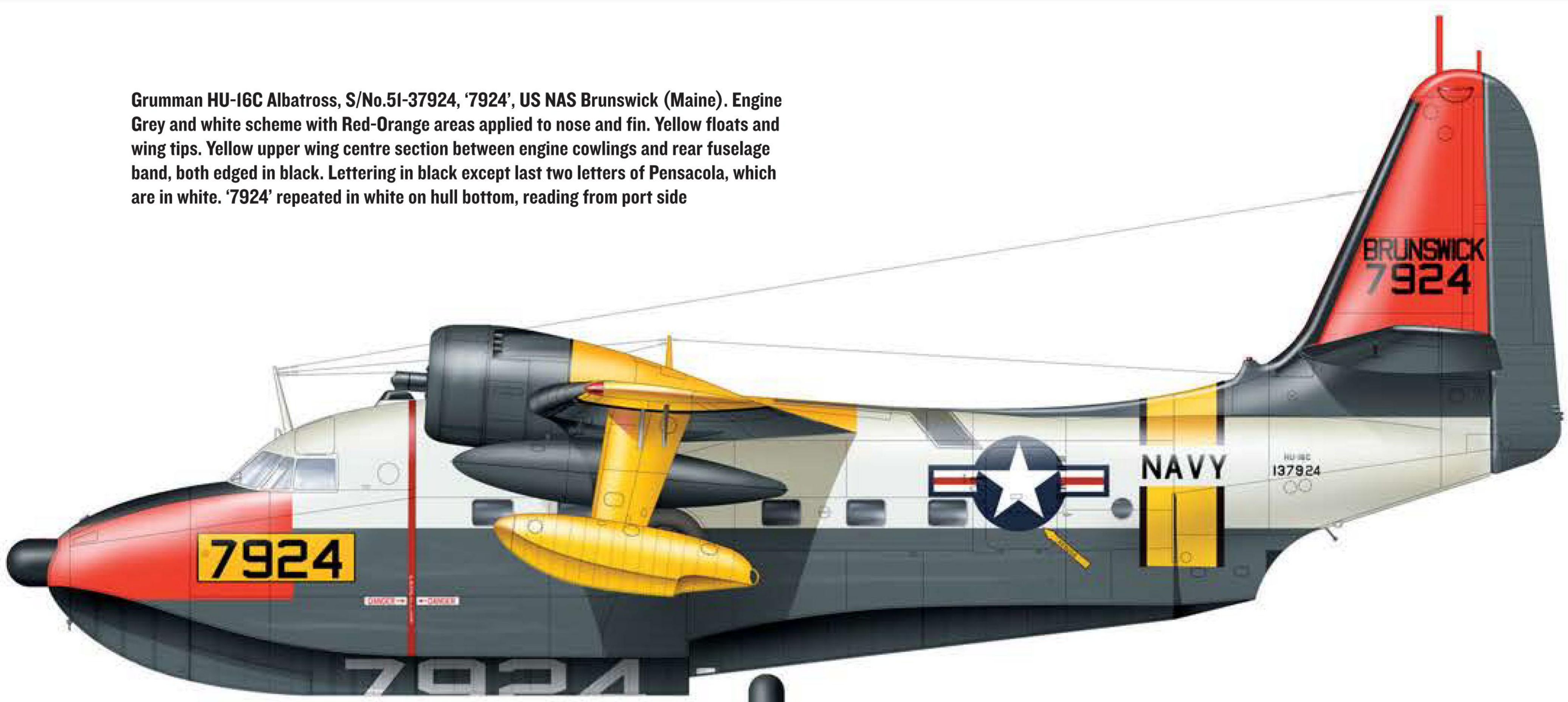
Above: Grumman HU-16A, S/No.MM.50-182, 140-22, 140^ Squadriglia, 15o Stormo SAR, Aeronautica Militare Italiana, 1961-1965. Aluminium (silver) overall, yellow rear fuselage band and wing tips, edged in black. Blue band, edged in yellow, across vertical tail surfaces with 'S.A.R.' in white. Codes and serial in black. National markings in four wing positions

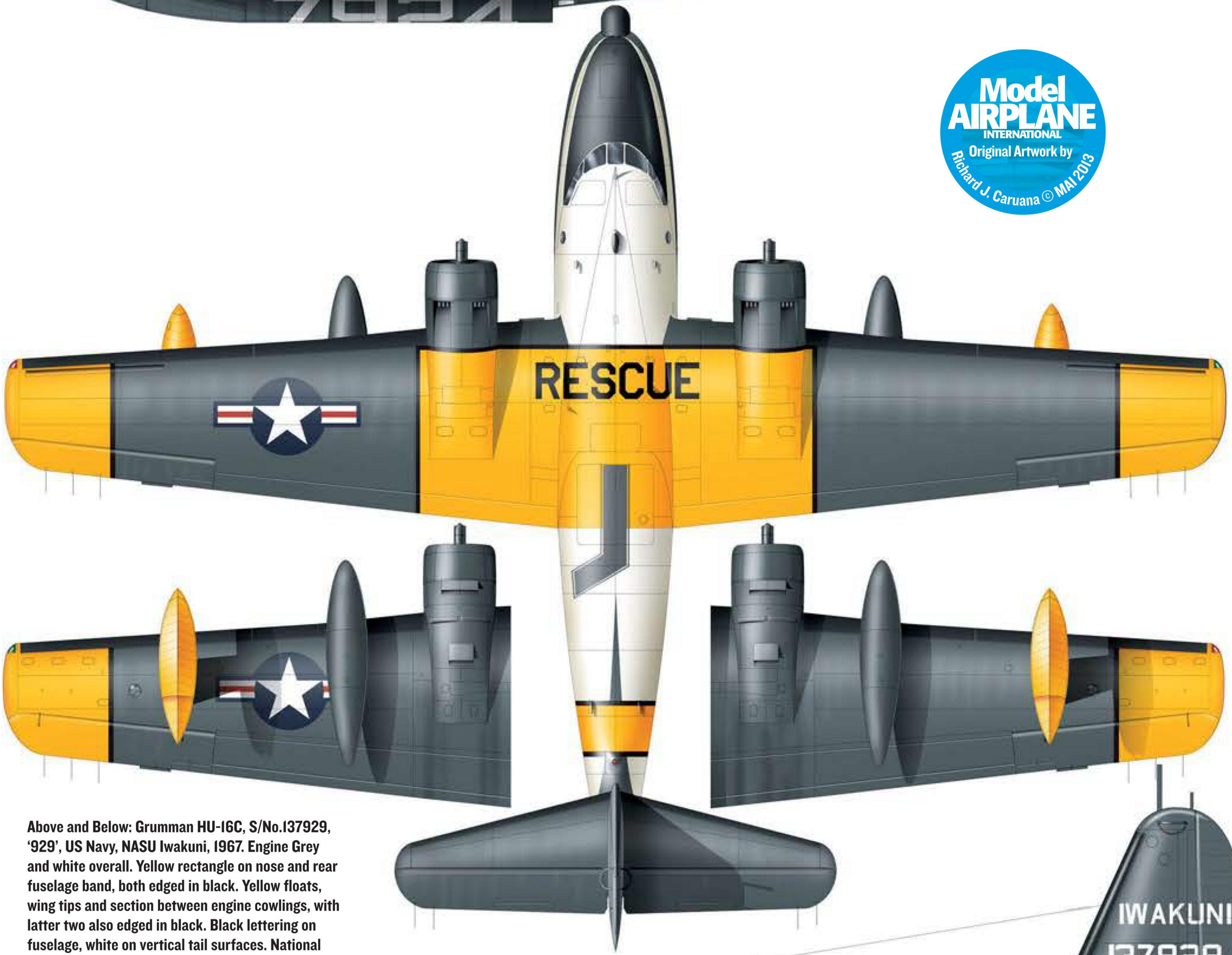
Below: Grumman HU-16A, S/No.MM.51-037, 15-9, 15o Stormo SAR, Aeronautica Militare Italiana, post 1974. Aluminium (silver) overall with yellow hull and wing tip floats. Yellow rear fuselage band and wing tips, edged in black. Orange nose and rear fuselage sections. Codes and serial in black

Grumman SA-16A Albatross, 6534/34, 2o/10o Gav-Esq. Pelicano, Força Aerea Brazileira, 1966. Aluminium lacquer overall with white fuselage top decking. Yellow-orange floats, wing tips and rear fuselage band. Black with orange edge band and white 'SAR' letters on fin. All other lettering in black. National markings in six positions

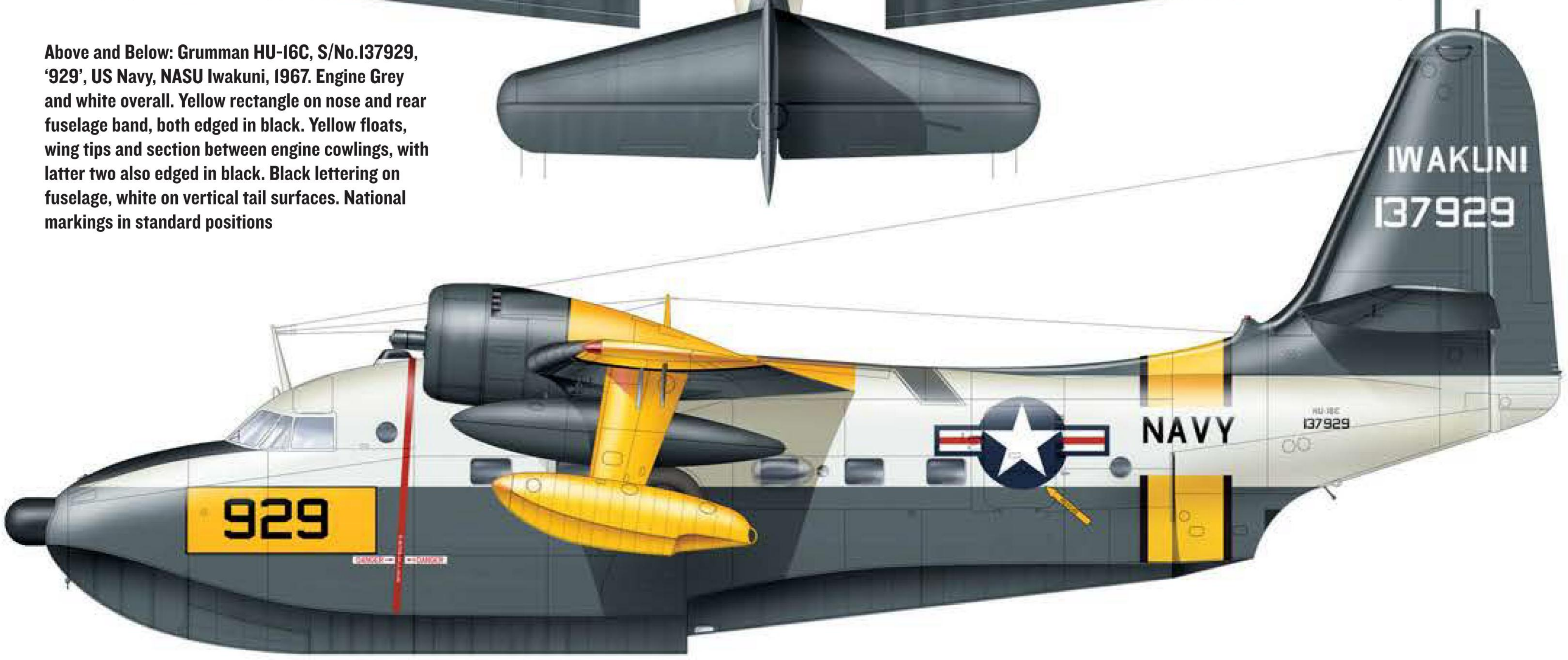


Grumman HU-16C Albatross, S/No.51-37924, '7924', US NAS Brunswick (Maine). Engine Grey and white scheme with Red-Orange areas applied to nose and fin. Yellow floats and wing tips. Yellow upper wing centre section between engine cowlings and rear fuselage band, both edged in black. Lettering in black except last two letters of Pensacola, which are in white. '7924' repeated in white on hull bottom, reading from port side





Above and Below: Grumman HU-16C, S/No.137929, '929', US Navy, NASU Iwakuni, 1967. Engine Grey and white overall. Yellow rectangle on nose and rear fuselage band, both edged in black. Yellow floats, wing tips and section between engine cowlings, with latter two also edged in black. Black lettering on fuselage, white on vertical tail surfaces. National markings in standard positions



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TIGER...TIGER...

THE DE HAVILLAND DH.82 TIGER MOTH

G-ANEL is here seen its wartime camouflage and markings and its original serial: N9238. Of particular interest is the 'shadow compensation scheme' correctly applied to this Tiger Moth, where the top of the lower wings were finished in Light Earth and Light Green in contrast to the rest of the airframe which is finished in Dark Earth and Dark Green. Old Warden, 1978 (©Richard J. Caruana)

The concept of a simple, cheap, reliable and easy-to-fly aeroplane was foremost in Sir Geoffrey de Havilland's mind when his aviation company embarked on the design and production of the Moth series of biplanes in the mid-1920s. His dream was to promote flying to a wider section of the population at a time when growing enthusiasm towards aviation was influenced by widely publicised record-breaking feats.

First in line was the DH.60, which performed its maiden flight at the company's airfield at Stag Lane on 22nd February 1925. It soon gained popular support making it an instant success, so much so that the Director of Civil Aviation, Sir Sefton Brancker, ordered the acquisition of 90 examples for the growing number of government-sponsored flying clubs. As supplies of the Cirrus engine that originally powered the DH.60 began to dry out De Havilland sought the assistance of engine designer Major Frank Halford to provide an alternative power plant. By 1927 tests of the four-cylinder Gypsy had produced encouraging results, producing 135hp for a weight of 295lb. Most importantly, the Gypsy was a completely new engine and did not rely on the availability of ex-World War One parts salvaged from the eight-cylinder Renault engines. Derated to 50hp it became the standard power plant for the DH.60G the following year, flying for the first time in the company-owned Moth G-EBQH and soon became known as the Gypsy Moth. Further development of both engine and airframe resulted in the Gypsy II that provided 120hp and the Gypsy III of 130hp, the latter becoming known as the Gypsy Major. Building the engines in house meant that De Havilland could streamline its production facilities to build engines and airframes in parallel and in equal numbers. Airframe development was centred around the replacement of the original wooden-frame fuselage construction by a welded steel tube fuselage structure in the DH.60M, thus becoming known as the Metal Moth. This was also the first Moth design to be acquired by the Royal Air Force (RAF) in substantial numbers and was also built under licence in Australia, the United States, Canada and Norway.

Enter the Tiger

A trainer version designated DH.60T, incorporating further strengthening of the framework to accept cameras, practice bombs and possibly even radio equipment, was rejected by the RAF. Main concern was the problematic access to the front cockpit. Encouraged by suggestions for improvement by the Aircraft & Armament Experimental Establishment (A&AEE) at Martlesham Heath, De Havilland pursued with its military variant. Such access was hampered on the standard

Tiger Moth G-ANFW was purchased by the Malta Aviation Museum Foundation in 2000 and was restored to its wartime original configuration and scheme as DE730. It returned to fly in 2010 and has been displayed at Malta's International Air Show and featured in an Australian TV production. The Battle of Britain Memorial Flight's Dakota can be seen in the background (©Richard J. Caruana)

Moth due to the proximity of the aircraft's fuel tank in the top wing centre section placed directly above the front cockpit. A solution was found by moving the tank's position forward while sweeping the wings back to maintain centre of lift without major redesign to the fuselage. Both occupants were also provided with fold-down doors on both sides of the cockpits. Design and development of this new version was, in itself, an amazing feat by the design team led by Arthur Hagg, assisted by F.T. Hearle and F.C. Plumb. A dismantled Moth airframe was used as a full-scale mock-up and the new machine evolved without the aid of the drawing department! A prototype was ordered against Air Ministry Specification 15/31, which was based on the DH.60T with the incorporation of staggered and swept-back wings together with increased dihedral to the lower wings. The result was works number 1733, registered G-ABRC; such was the difference between this aircraft and its predecessors that it was given the type designation DH.82; the Tiger Moth was born. Powered by a Gypsy III 120hp engine, the prototype was flown for the first time on 26th October 1931 by De Havilland's chief test pilot Hubert Broad. The Tiger Moth's success was immediate. It proved simple and cheap to produce and maintain while at the same time being a reliable and stable aircraft. If was fully certified for aerobatics up to 1,750lb and highly suited for blind flying with the possibility of easily adding a hood over the rear cockpit. An initial order for 35 examples was made by the Air Ministry through its Specification T.23/31 (K2567-2601) and named the type Tiger Moth Mk I. The first 15 of these were delivered in November 1931 to No.3 Flying Training School, RAF Grantham where the first pupils learned to fly in what was to become the standard training aircraft for thousands of RAF and Commonwealth pilots. By the following year the Central Flying School was proudly displaying the aerobatic qualities of its new aircraft at the RAF Display at Hendon.

September 1934 marked the appearance of an improved version in the form of the DH.82A. Carying civilian registration G-ACDA, works number 3174 featured the new Gypsy Major I engine which provided 130hp together with an external refinement of the airframe. The latter consisted in replacing the previous fabric-covered over stringers of the fuselage dorsal section aft of the rear cockpit with one made from plywood. Access doors to the front cockpit were also slightly modified by replacing the deep hinged doors will smaller ones. Fuel capacity was increased from 18 to 19 gallons. Fifty machines (K4242-4291) designated Tiger Moth Mk II were ordered by the RAF against Specification 26/33. All of these went to RAF Kenley with deliveries beginning in November 1934 from where they were then passed on to various RAF Elementary Flying Training Schools (EFTS), together with No.24 Squadron and a number of civilian Elementary and Reserve FTS. By that time the RAF had chosen the Tiger Moth as its main ab initio training aircraft, as the Mk II slowly but surely replaced some 400 Avro Tutors, some of which were still being delivered. Operating costs was to be the principal factor and understandably so when comparing the Tutors 240hp Lynx engine with the Tiger's 130hp Gypsy Major. Orders were flooding in not only from the RAF and civil flying schools but also from all over the world. Pressure for increased production of the Tiger Moth resulted in a major decision for de Havilland and his company. It became very clear that the restricted space at Stag Lane could not cope with future orders and with this in mind a number of open fields at Hatfield were purchased where a new factory and airfield could be built. Stag Lane was sold and Geoffrey de Havilland flew out of its airfield for the last time in July 1934. The situation in Europe had finally stimulated the RAF to embark on a major expansion programme, part of which was the establishment of the Royal Air Force Volunteer Reserve (RAFVR) in 1937 in which the Tiger Moth was to play a significant role. Another innovation was the introduction of anti-spin strakes on the far end of the fuselage that made their appearance on the Tiger Moth as war in Europe was on the brink of outbreak. When war broke out over 1000 Tiger Moths had been delivered, most of which had gone to the numerous EFTS where the majority of RAF pilots got their initial training before proceeding to the Flying Training Schools for further training before joining operational units. Wartime production of the Tiger Moth totalled 4,005 examples ending with PG746. Of these, 3,210 had been built by Morris Motors Ltd at Cowley, Oxford. A further 2,949 were built in Canada, Australia and New Zealand for the Commonwealth Air Training Plan. 1,548 examples were built by de Havilland Canada alone, including versions of the DH.82C powered by the Menasco-built engines, thus becoming known as the Menasco Moth. A further 200 were also built in Canada for the United States Army Air Force (USAAF) under Lend-Lease agreements under the designation PT-24, all of which were delivered to the Royal Canadian Air Force (RCAF). Sweden built 23 examples as the SK.11, 91 were built in Portugal, 38 in Norway and 133 were built in New Zealand.

The DH.82 Queen Bee externally looked like a Tiger Moth on floats but in actual fact was quite a different aircraft. To begin with the fuselage was the wooden-framed type of the DH.60 Gypsy Moth suitably modified to be fitted with the DH.82A wings. Although standard controls and equipment were retained in the front cockpit, the rear seat was removed and replaced by a radio-control system operating pneumatically-driven servos. It was built as a radio-controlled gunnery target version and the first examples began to be delivered in 1935. Queen Bee production consisted of 400 aircraft built by de Havilland at Hatfield and a further 70 by Scottish Aviation.

Tiger Moth G-ANRF, a Morris-built example still flying today here photographed at Old Warden on 19th October 1978. Purchased in 1974 by David Cyster it was restored and became the first of its type to fly from England to Australia during the 50th anniversary of the first solo flight between these two countries flown by Sqn Ldr Bert Hinklet in 1928. Note the front cockpit has been faired over (©Richard J. Caruana)

Sitting on the parched grass at Old Warden in July 1976 is G-AOBX finished in its wartime Royal Navy colours and carrying its original serial number T7187. A year before this picture was taken it was flying at Thorpe Park fitted with a set of floats but otherwise in the same finish
(©Richard J. Caruana)

Plenty of detail for the modeller in this close up view of the cockpit area of DE730 belonging to the Malta Aviation Museum, seen here during just before its roll-out ceremony at the end of a nine-year restoration programme. It is kept in fully airworthy condition
(©Richard J. Caruana)

In the wake of a possible invasion of British territory after the fall of France in the summer of 1940 plans were in hand to convert as many available aircraft for defensive purposes, and the first modification considered for the Tiger Moth was its possibility of carrying small calibre bombs to be used against ground troops. 350 examples were fitted with bomb racks as part of Operation Banquet, a British plan to use every available aircraft in a desperate effort to repel a possibility of invasion hatched on 13th July 1940 by the AOC-in-C, Training Command.

While University Air Squadrons and the RAFVR continued for quite a number of years to fly the Tiger Moth after the end of the Second World War, the RAF found that a considerable number of trainers were surplus to requirements and were sold to flying clubs and individuals. Most of these continued to fly to the present day. The type is also well represented in aviation museums all over the world. Certainly among the foremost reasons for its longevity is that the Tiger Moth is easy to fly, cheap to run and maintain and can be easily adopted for a number of roles. Not to be forgotten the number of times the type acted as a stand in, at times externally modified, for other aircraft in a number of films.

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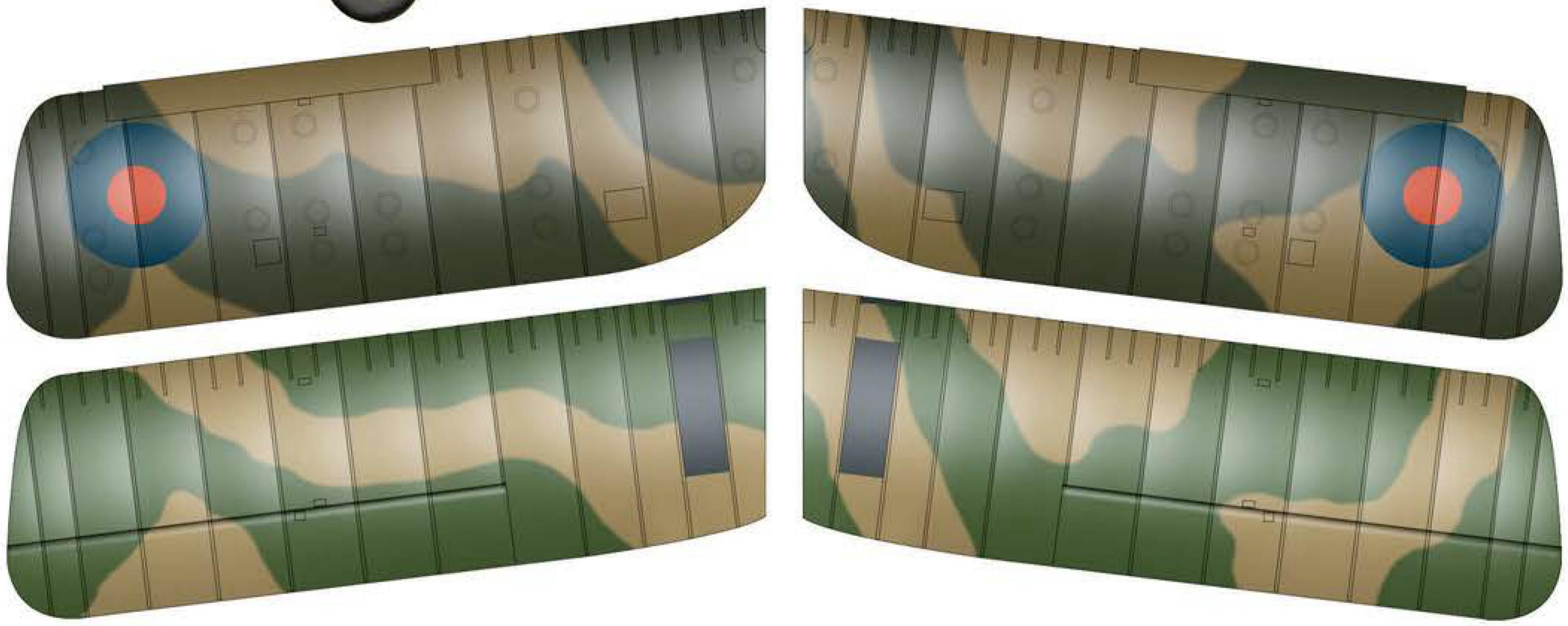
De Havilland DG.82A Tiger Moth, G-ADZN, 'Black 30', No.10 Elementary Flying Training School, RAF, Yalesbury, April 1940. 'Shadow compensation scheme' of Dark Earth/Dark Green on upper surfaces with Light Earth and Light Green on top of lower wings. Trainer Yellow undersides, vertical tail surfaces and elevators. Night registration, repeated below wings. Type B blue/red roundels above top wings



De Havilland DH.82A Tiger Moth, N9374, 'Black 70', No.22 Elementary Flying Training School, RAF, Cambridge, 1940. Early 'shadow compensation scheme' of Dark Earth/Dark Green on upper surfaces with Light Earth and Light Green on top of lower wings. Trainer Yellow undersides. Night serial, repeated below wings. Night code '70', outlined in Trainer Yellow. Type B blue/red roundels above wings

De Havilland DH.82A Tiger Moth Mk II, T8209, 'White 10', No.25 (Polish) Elementary Flying School, Hucknall, 1943. Dark Earth and Dark Green upper surfaces with Trainer Yellow undersides. Night serial, white code on engine cowling. Polish flag on fuselage sides. Type B blue/red roundels above top wings. Note 'Mustard' gas detection patch above rear fuselage

De Havilland DH.82A Tiger Moth Mk II, EM973 •YO, No.401 Squadron, 1943. Dark Earth and Dark Green upper surfaces with Trainer Yellow undersides. Codes in Medium Sea Grey, serials in Night. Black/white/red 'sharkmouth' motif on engine cowling. Squadron hack, carrying the 'YO' codes applied on the squadrons' Spitfires at the time

De Havilland DH.82A Tiger Moth Mk II, T7741, 'Black 42', No.25 (Polish) EFTS, late 1943. Dark Earth and Dark Green upper surfaces with Trainer Yellow undersides. All lettering in black with serial repeated below lower wings. Yellow lower part of cowling, top wing tips and fuselage band. Type B blue/red roundels above top wing

De Havilland DH.82A Tiger Moth Mk II, DE745, assigned to the 353rd Fighter Group, USAAF Station 366 (RAF Metfield), September 1943. Dark Earth and Dark Green upper surfaces with Trainer Yellow undersides. US national markings with yellow outer surround on fuselage sides, above upper port and below lower wings; note RAF fin flash overpainted, probably with Olive Drab. Name 'Dorothy' in red, outlined in white, on fuselage side

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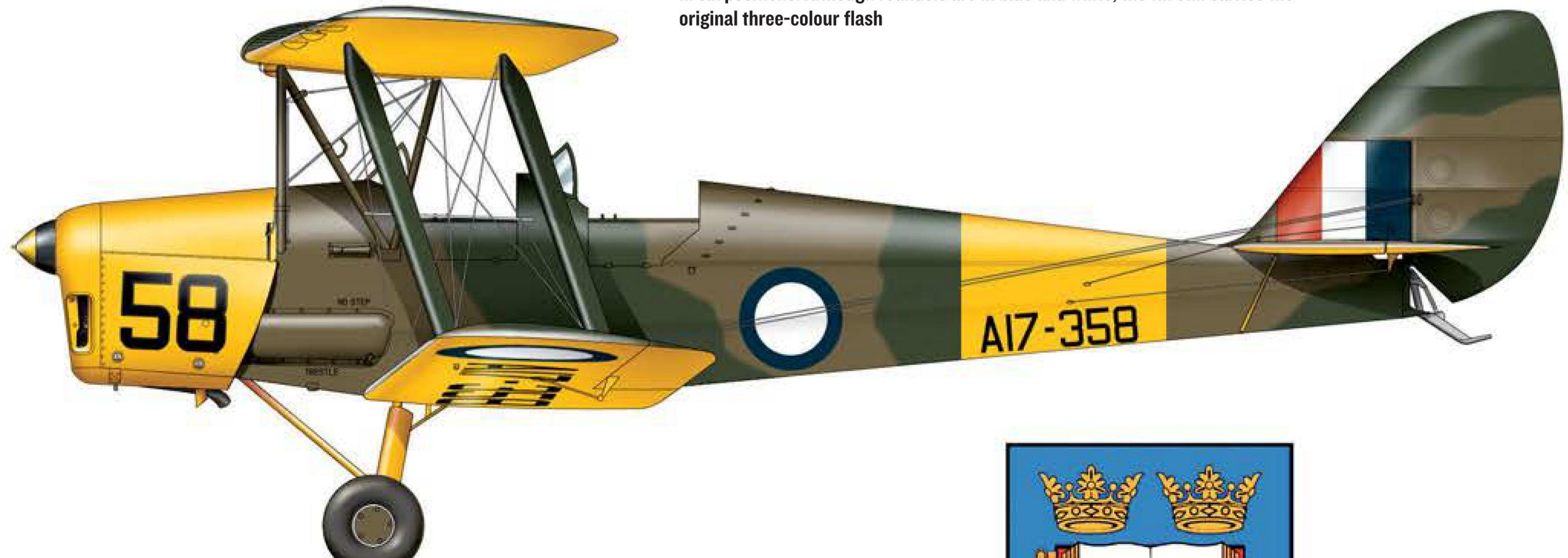
De Havilland DH.82A Tiger Moth Mk II, 680, 'White 12', No.28 EFTS, Rhodesian Air Training Group, Mount Hampden (Southern Rhodesia), May 1942. Trainer Yellow overall. Serial in black, code on engine cowling in white. Red/white checks around rear fuselage. Roundels in six positions

De Havilland DH.82A Tiger Moth Mk II, A17-616, BF•Z, No.5 (Army Co-Operation) Squadron, RAAF, Mareeba (Queensland), summer 1943. Earth Brown and Foliage Green upper surfaces with Sky Blue undersides. Serial in black, codes in Neutral Grey. National markings in six positions

De Havilland DH.82A Tiger Moth Mk II, A17-358, 'Black 58', No.1 Air Observer School RAAF, Cootamundra, 1943. Earth Brown and Foliage Green upper surfaces with Trainer Yellow undersides. Trainer Yellow cowling, rear fuselage band and chordwise bands above top wings. Serial and code in black. National markings in six positions. Although roundels are in blue and white, the fin still carries the original three-colour flash



De Havilland DH.82A Tiger Moth Mk II, T6026, •ROUD, Oxford University Air Squadron, 1947. Trainer Yellow overall. All lettering in black with serial repeated below lower wings. Blue/white/red roundels above top and below lower wings. Oxford University shield on engine cowling

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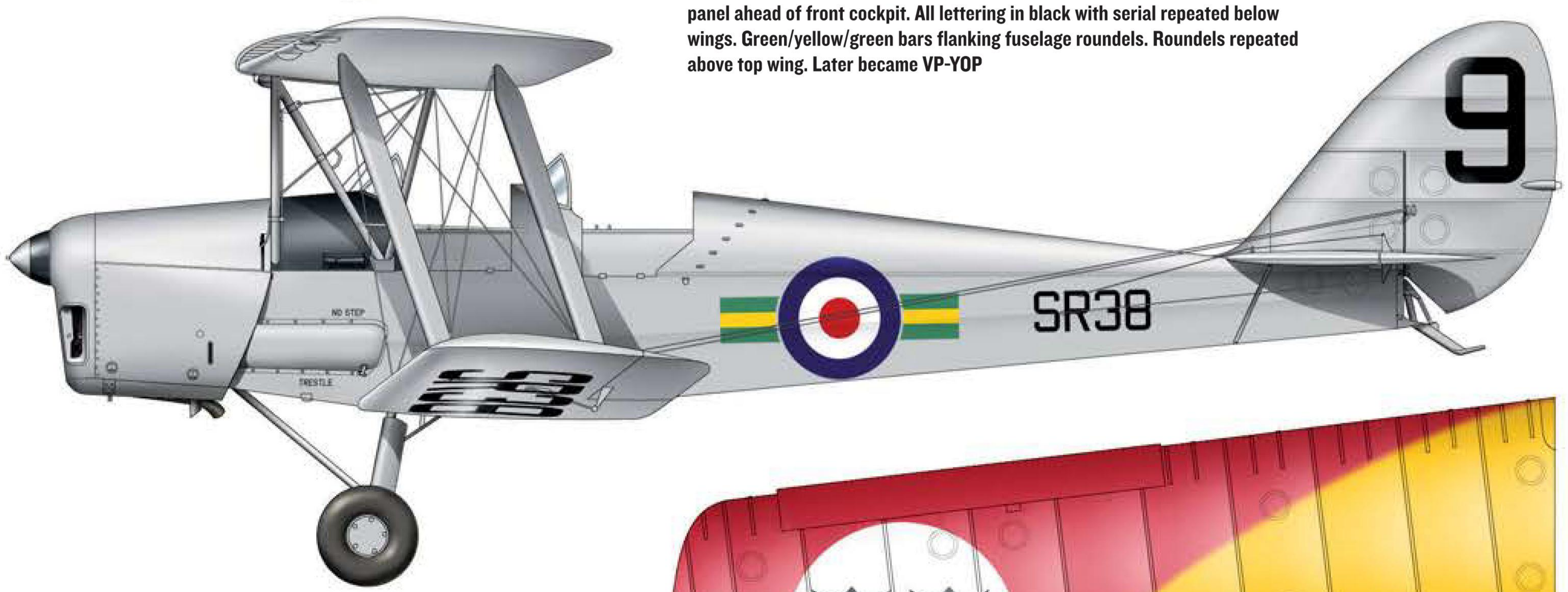
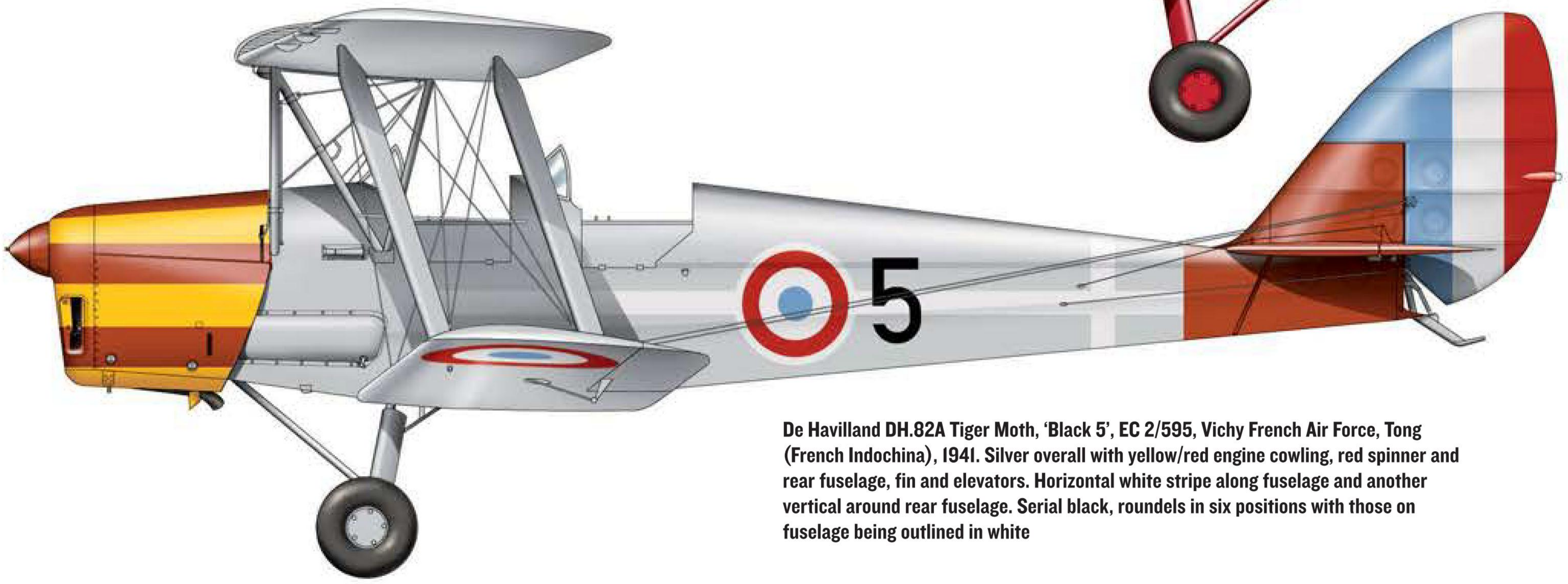
De Havilland DH.82A Tiger Moth T Mk 2 (ex G-AFST, impressed 15.01.1940), W7957, GP•2C, No.727 Naval Air Squadron FAA, Gosport, 1950. Trainer Yellow overall with all lettering in black. Serial repeated below wings. Post-war style roundels in six positions

De Havilland DH.82A Tiger Moth Mk II, DE709, BD•X, Army Air Corps Centre (British Army Elementary Flying Training School), Middle Wallop, 1955. Silver overall with yellow bands around rear fuselage and chord- wise above the top wings and below the bottom wings. Codes and serials in black. Roundels in six position. Red spinner front and wheel hubs. Went to Australia and still flying in Victoria as VH-BPU

De Havilland DH.82A Tiger Moth, SR38/9, Flying Training School, Southern Rhodesian Air Force, Cranbourne, 1948-49. Silver overall with black anti-dazzle panel ahead of front cockpit. All lettering in black with serial repeated below wings. Green/yellow/green bars flanking fuselage roundels. Roundels repeated above top wing. Later became VP-YOP



De Havilland SK.11 (DH.82A) Tiger Moth, 5•3, Swedish Air Force, 1935. Yellow overall with red trim. Codes in black, with '3' repeated on engine cowling. National markings in black and white in six position



De Havilland DH.82A Tiger Moth, 'Black 5', EC 2/595, Vichy French Air Force, Tong (French Indochina), 1941. Silver overall with yellow/red engine cowling, red spinner and rear fuselage, fin and elevators. Horizontal white stripe along fuselage and another vertical around rear fuselage. Serial black, roundels in six positions with those on fuselage being outlined in white

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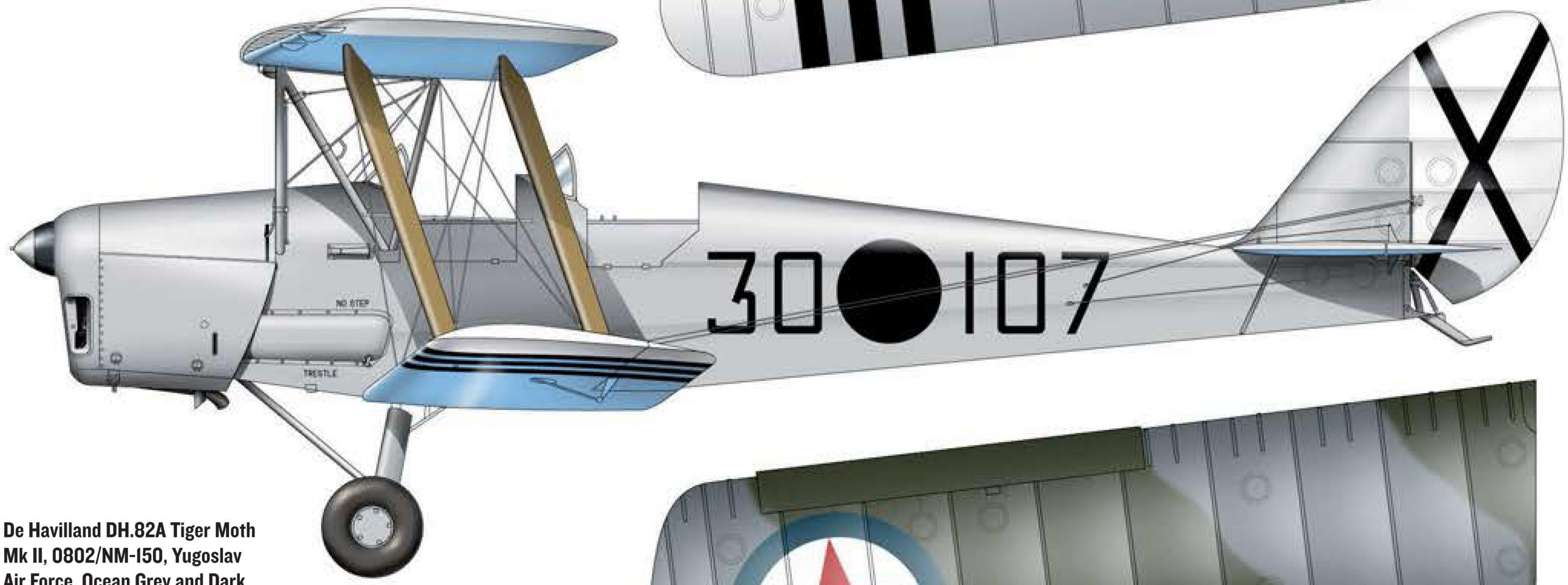
De Havilland DH.82A Tiger Moth, MO-159, LeLv26, Finnish Air Force, 1943. Oliivinvihre (Olive Green) upper surfaces and Vaaleanharmaa (Very Light Grey) undersides. Underside of wing tips and fuselage band in yellow. Codes in black. National markings in six positions

De Havilland DH.82A Tiger Moth, 30•107. Spanish Air Force, post-civil war. Silver overall with Azure Blue underside of wings and tailplane. White wing tips and rudder. All markings in black, with three black bands above top and below lower wing tips



De Havilland DH.82A Tiger Moth Mk II, 0802/NM-150, Yugoslav Air Force. Ocean Grey and Dark Green upper surfaces with Trainer Yellow undersides. Serials in Night. National markings in four wing positions

De Havilland DH.82A Tiger Moth, PG712, 'White 2', Royal Netherlands Air Force, 1946. Dark Earth and Dark Green upper surfaces with Trainer Yellow undersides. Serial in black, code '2' on engine cowling in white. National markings in six positions. Currently kept in flying condition registered PH-CSL

Convair F-102A-8--CO Delta Dagger, S/No.56-1433, 18th FIS, Wurtsmith AFB, Michigan, 1956. Gloss Grey FS.16473 overall with unpainted radome (tan). Blue/yellow bands, over white, on fin; unit badge on fin. All lettering in black

Convair F-102A Delta Dagger, S/No.56-1383, 326th FIS, Richards-Gebaur AFB, Missouri, 1957- 1958. Gloss Grey FS.16473 overall with yellow wing fences, wingtips, radome and nose probe. Blue/yellow fin trim with unit badge. All lettering in black

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Convair F-102A-15-CO Delta Dagger, S/No.53-1802, 16th FIS, Naha AFB, Okinawa, 1959. Gloss Grey FS.16473 overall with blue wing fences; black/white checks on fin, with blue bars above and below. Unit badge on white disc on fin. All lettering in black

Convair F-102A-45-CO Delta Dagger, S/No.55-3403, 318th FIS, McCord AFB, Washington, 1959. Gloss Grey FS.16473 overall with all lettering in black. Unit badge on nose, yellow/blue motif on tail (inspired by the Chrysler 'Way Forward' logo. Black airbrake

Convair F-102A-55-CO Delta Dagger, S/No.56-1017, 48th FIS, Langley AFB, Virginia, May 1960. Gloss Grey FS.16437 overall; white vertical tail surfaces with green stars and unit badge. Red wing fences. All lettering in black

Convair F-102A-40-CO Delta Dagger, S/No.54-1405, 496th FIS, Hahn AFB, Germany, 1960. Gloss Grey FS.16473 overall with unpainted radome; all lettering in black. Black/yellow vertical tail surfaces with unit badge at cente; black airbrake, yellow wing fences. Black/yellow bands around nose

Convair F-102A-80-CO Delta Dagger, S/No.56-1447, 57th FIS, Keflavik AFB, Iceland, 1963. Natural metal overall with Red FS.12197 tail and wing tips. Unit badge on fin; note drop tank markings

Convair F-102A-70-CO Delta Dagger, S/No.56-1263,01, 190th FIS, Idaho ANG, August 1970. Uppersurfaces in Tan (FS.30219), Medium Green (FS.34012), Dark Green (FS.34062) with Light Grey (FS.36622) undersides. Sharkmouth motif on nose in red/blue/white. All lettering in black, except '01' on fin which is in white. ANG badge on fin

Convair F-102A-80-CO Delta Dagger, S/No.56-1436/PK, flown by Col. E.P. McNell, CO of 50th FIS, Udorn RTAFB, Thailand, in 1968. Uppersurfaces in Tan (FS.30219), Medium Green (FS.34012), Dark Green (FS.34062) with Light Grey (FS.36622) undersides. Yellow/black bands around mid fuselage. Lettering in white and black on fin. Note art on nosewheel door

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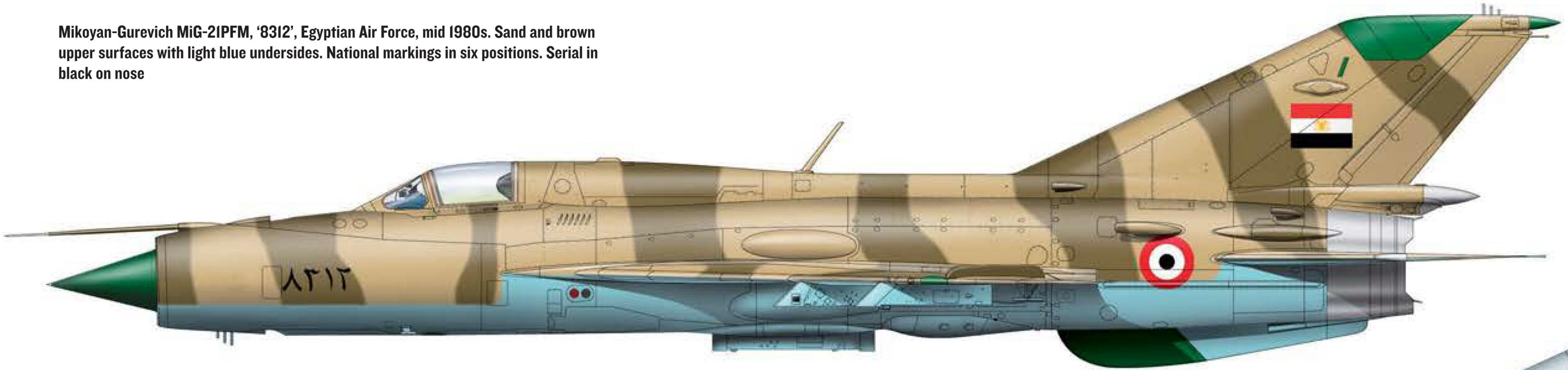
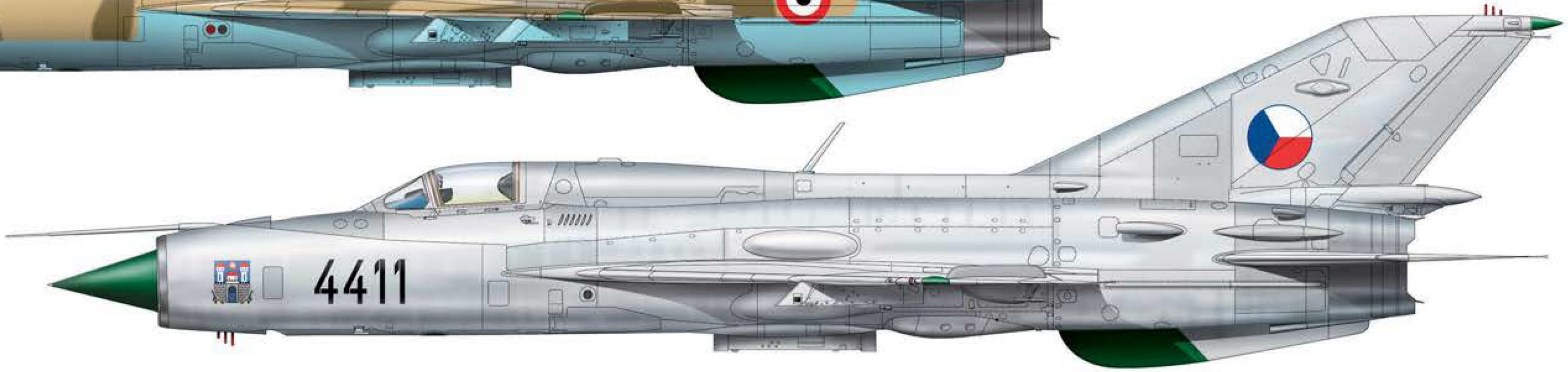
Mikoyan-Gurevich MiG-21PFM, '8312', Egyptian Air Force, mid 1980s. Sand and brown upper surfaces with light blue undersides. National markings in six positions. Serial in black on nose

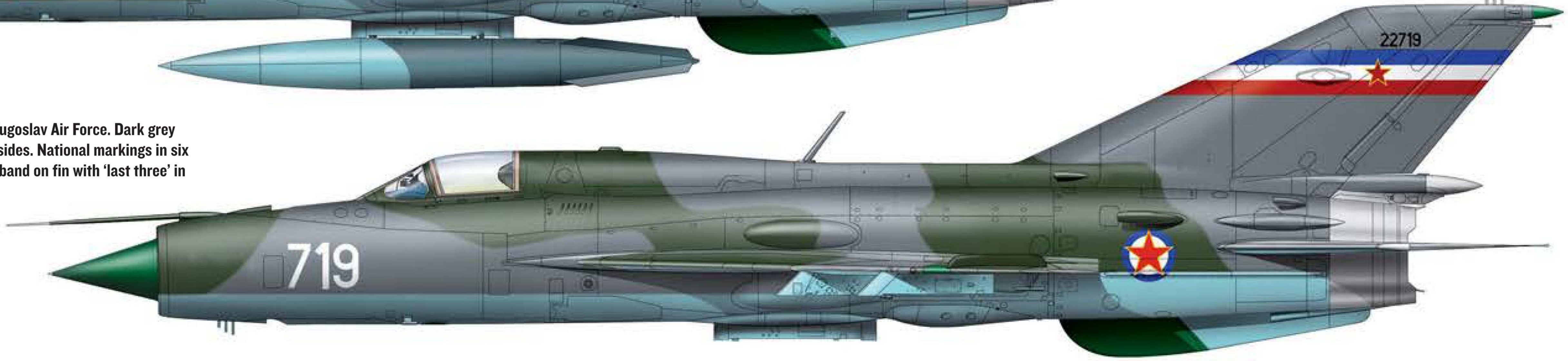


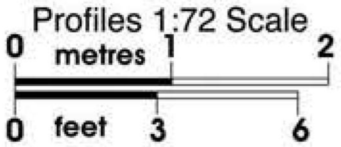
Mikoyan-Gurevich MiG-21PFM (late version), '4411', 11 Fighter Regt, Czechoslovakian AF. Natural metal overall with black serial on nose. National markings in six positions. Unit badge on nose



Mikoyan-Gurevich MiG-21PFM, 'Red 935', JG1, FAG-15, Rothenburg, 1990. Dark brown and dark green upper surfaces with light blue undersides. National markings on fin and four wing positions. Code in red

Mikoyan-Gurevich MiG-21PFM, 22719, 'White 719', Yugoslav Air Force. Dark grey and dark green upper surfaces with light blue undersides. National markings in six positions. Serial in black above tri-colour horizontal band on fin with 'last three' in white on nose

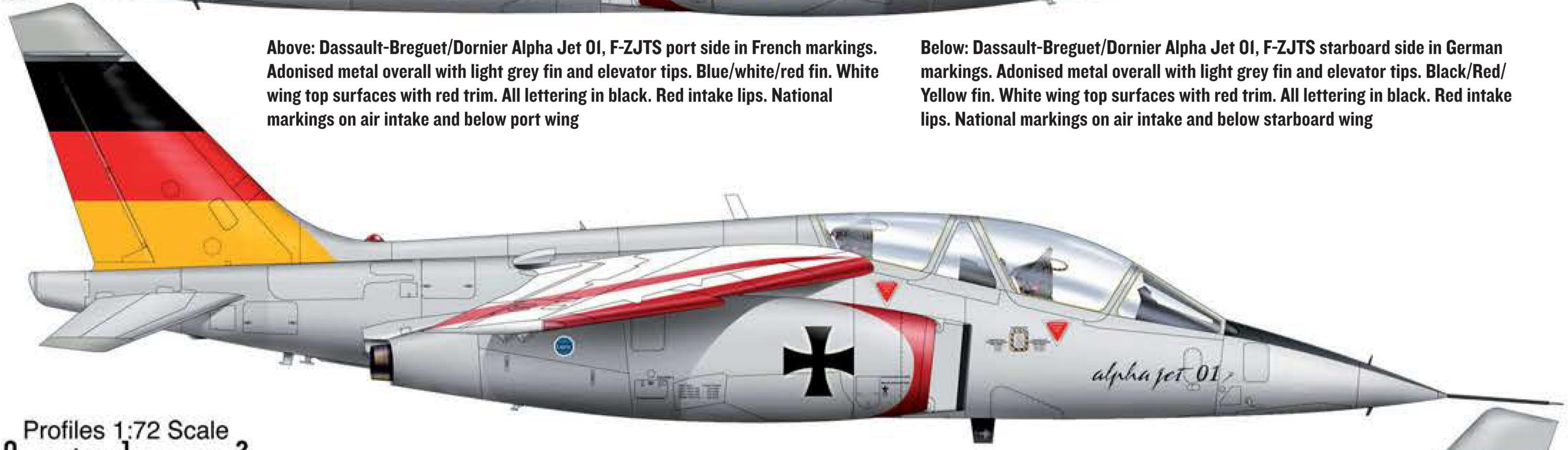




DASSAULT-BREGUET/DORNIER *alpha jet*

Above: Dassault-Breguet/Dornier Alpha Jet 01, F-ZJTS port side in French markings. Adonised metal overall with light grey fin and elevator tips. Blue/white/red fin. White wing top surfaces with red trim. All lettering in black. Red intake lips. National markings on air intake and below port wing

Below: Dassault-Breguet/Dornier Alpha Jet 01, F-ZJTS starboard side in German markings. Adonised metal overall with light grey fin and elevator tips. Black/Red/Yellow fin. White wing top surfaces with red trim. All lettering in black. Red intake lips. National markings on air intake and below starboard wing



Profiles 1:72 Scale
0 metres 1 2
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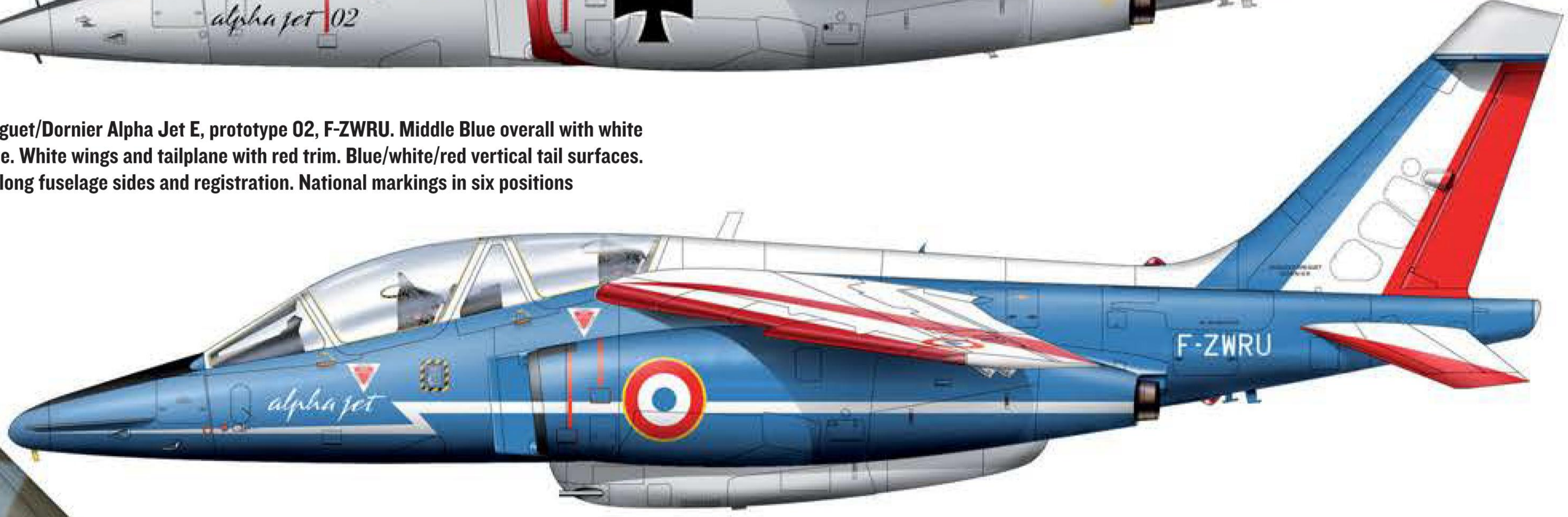
Dassault Breguet/Dornier Alpha Jet 02, first flown on 9th January 1974. Adonised metal overall with red intake lips. National German markings in six positions. Alpha Jet 02 logo on nose in black

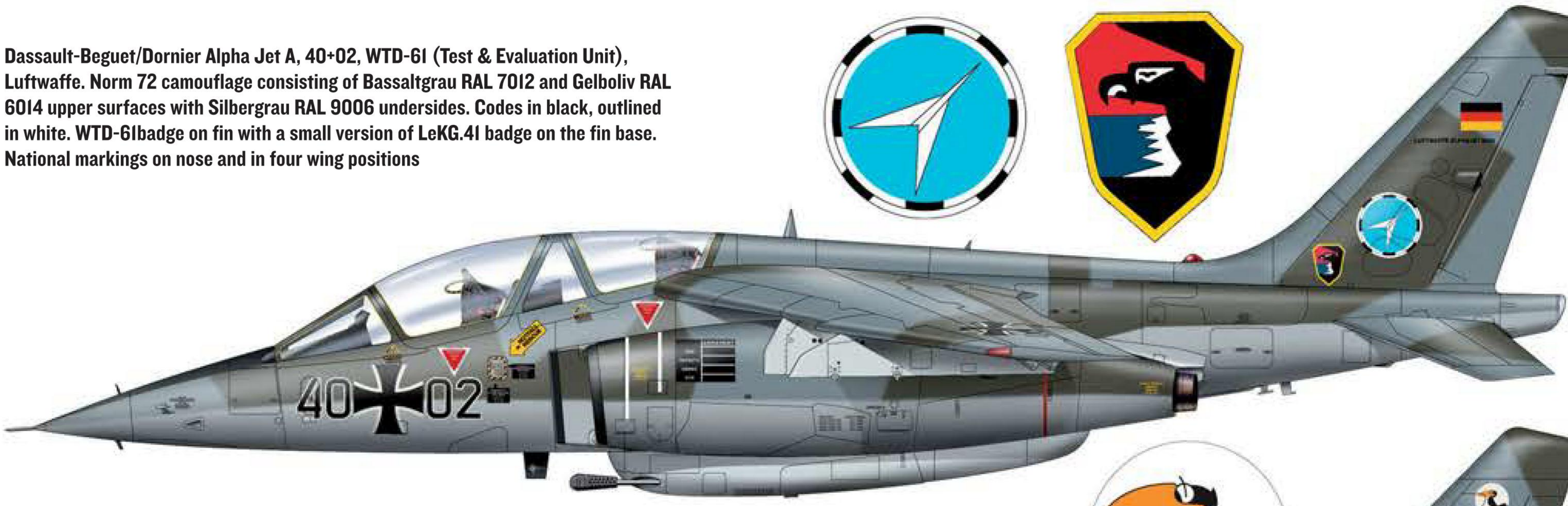
Dassault-Breguet/Dornier Alpha Jet E, prototype 02, F-ZWRU. Middle Blue overall with white fuselage spine. White wings and tailplane with red trim. Blue/white/red vertical tail surfaces. White flash along fuselage sides and registration. National markings in six positions



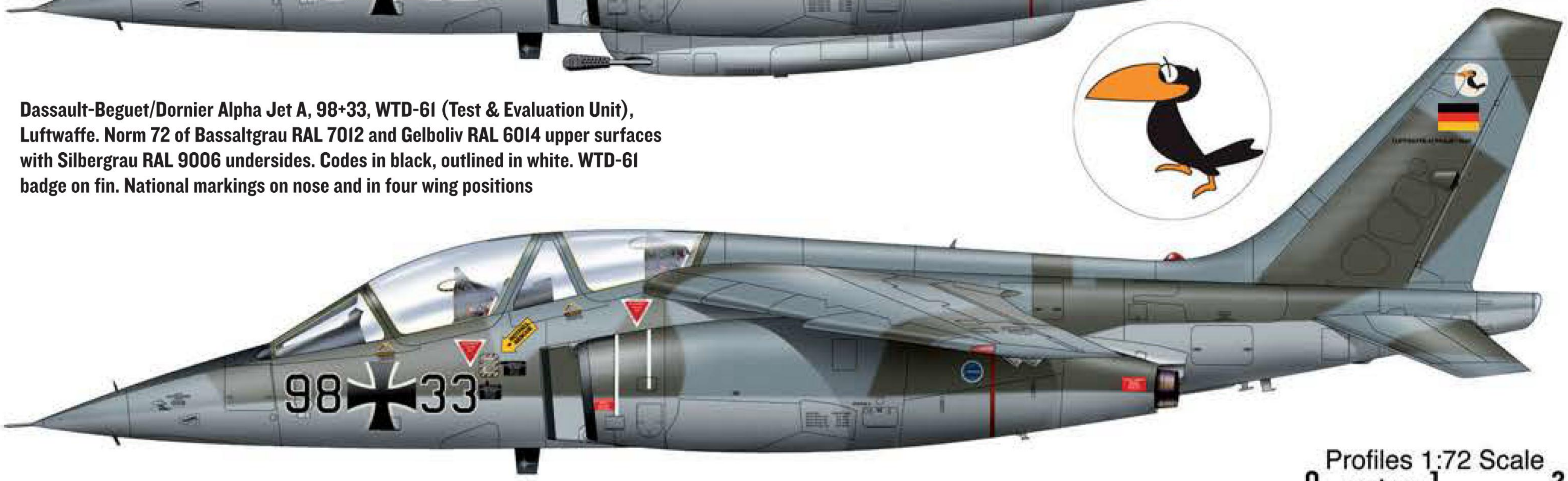
Above: Dassault Breguet/Dornier Alpha Jet '40+01', F-ZWRW, first production aircraft for the Lufwaffe. Norm 72 finish: Bassaltgrau RAL 7012 and Gelboliv RAL 6014 upper surfaces with Silber RAL 9006 undersides. Bassaltgrau RAL 7012 and Gelboliv RAL 6014 upper surfaces with Silber RAL 9006 undersides. Codes in black, outlined in white; French registration on rear fuselage in black. National markings on fuselage sides and in four wing positions. Jabo 41 and Jabo 43 markings on nose

Below: Dassault Breguet/Dornier 'Alpha Jet, '40+01',' WTD 61 (Test and Evaluation Unit), Manching, Luftwaffe. Norm 72 finish. Codes in black, outlined in white. National markings on fuselage sides and in four wing positions

Dassault-Beguet/Dornier Alpha Jet A, 40+02, WTD-61 (Test & Evaluation Unit), Luftwaffe. Norm 72 camouflage consisting of Bassaltgrau RAL 7012 and Gelboliv RAL 6014 upper surfaces with Silbergrau RAL 9006 undersides. Codes in black, outlined in white. WTD-61badge on fin with a small version of LeKG.41 badge on the fin base. National markings on nose and in four wing positions



Dassault-Beguet/Dornier Alpha Jet A, 98+33, WTD-61 (Test & Evaluation Unit), Luftwaffe. Norm 72 of Bassaltgrau RAL 7012 and Gelboliv RAL 6014 upper surfaces with Silbergrau RAL 9006 undersides. Codes in black, outlined in white. WTD-61 badge on fin. National markings on nose and in four wing positions



Profiles 1:72 Scale
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Below: Luftwaffe Norm 72 camouflage pattern of Alpha Jets upper surfaces consisting of Bassaltgrau RAL 7012 and Gelboliv RAL 6014 upper surfaces with Silbergrau RAL 9006 undersides

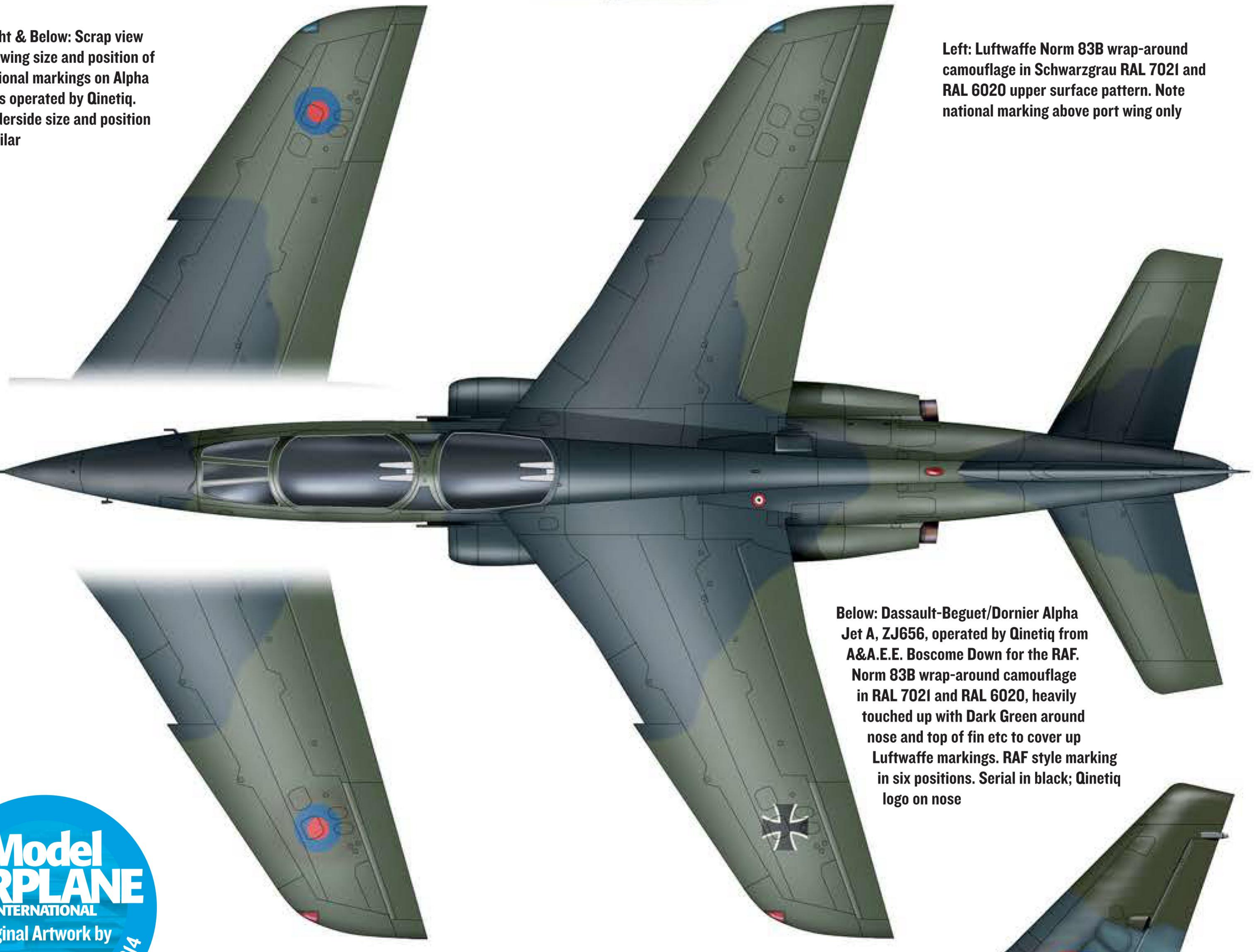
Position and size of underwing Luftwaffe Alpha Jet markings

Dassault-Beguet/Dornier Alpha Jet A, 40+40, JaboG 49. Luftwaffe. Bassaltgrau RAL 7012 and Gelboliv RAL 6014 upper surfaces with Silbergrau RAL 9006 undersides. Codes in black, outlined in white. Unit badge on fin. National markings on nose and in four wing positions

Dassault-Beguet/Dornier Alpha Jet A, 40+38, LeKG 43, Luftwaffe. Bassaltgrau RAL 7012 and Gelboliv RAL 6014 upper surfaces with Silbergrau RAL 9006 undersides. Codes in black, outlined in white. Unit badge on fin. National markings on nose and in four wing positions

Dassault-Beguet/Dornier Alpha Jet A, 41+67, JaboG 49, Luftwaffe. Norm 83B wrap-around camouflage in Schwarzgrau RAL 7021 and RAL 6020. Codes in black, outlined in white. Unit badge on fin. National markings on nose, above port wing and below starboard wing

Right & Below: Scrap view showing size and position of national markings on Alpha Jets operated by Qinetiq. Underside size and position similar



Left: Luftwaffe Norm 83B wrap-around camouflage in Schwarzgrau RAL 7021 and RAL 6020 upper surface pattern. Note national marking above port wing only

Below: Dassault-Beguet/Dornier Alpha Jet A, ZJ656, operated by Qinetiq from A&A.E.E. Boscome Down for the RAF. Norm 83B wrap-around camouflage in RAL 7021 and RAL 6020, heavily touched up with Dark Green around nose and top of fin etc to cover up Luftwaffe markings. RAF style marking in six positions. Serial in black; Qinetiq logo on nose

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Profiles 1:72 Scale
0 metres 1 2
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Dassault Breguet Dornier AlphaJet E, E26/314-TK, 314e Groupement Ecole 'Christian Martel', Tours, Armée de l'Air, 1980. Gris Bleu Foncé and Vert Foncè upper surfaces with Aluminium (Silver) undersides. Code in outline and solid black. Dayglo patch on fin and wing tips. Unit badge on fin. National markings in six positions

Above: Dassault-Breguet/Dornier Alpha Jet-E, E5/8-NS, Groupement Ecole 2/8 'Nice', Armèe de l'Air, Cazaux, France, mid 1990s. Gris Bleu Foncé and Vert Foncè upper surfaces with Aluminium (Silver) undersides. Dayglo patches to fin and wing tips. Code in outline and solid black. Panther marking on port side of fin, Storm marking on starboard. National markings in six positions.
For upper surface camouflage pattern and position of markings above and below wings refer to drawings at right

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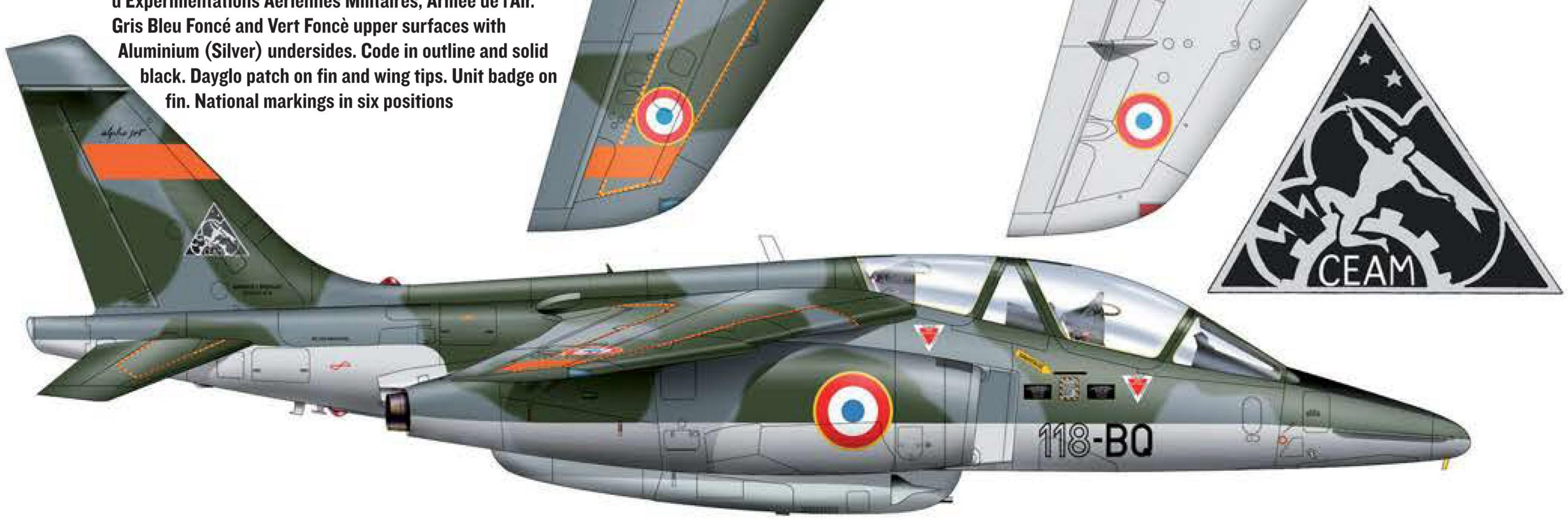
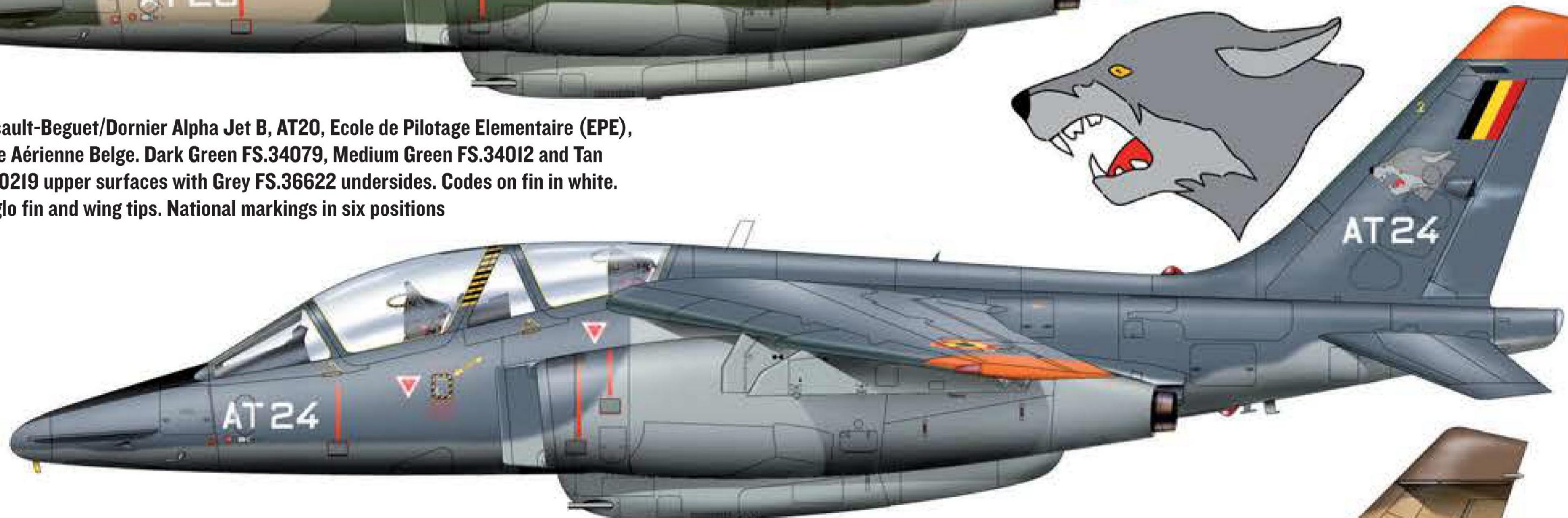
Dassault Breguet Dornier AlphaJet E, E2/118-BQ, Centre d'Experimentations Aeriennes Militaires, Armée de l'Air. Gris Bleu Foncé and Vert Foncè upper surfaces with Aluminium (Silver) undersides. Code in outline and solid black. Dayglo patch on fin and wing tips. Unit badge on fin. National markings in six positions



Dassault-Breguet/Dornier Alpha Jet E, E140/2-FA, E.E. 5/2 'Cote d'Or', Armèe de l-Air, Dijon, 2007. Gris Bleu Foncé overall with all lettering in black. Yellow flash on fin with unit badge superimposed (both sides). Dayglo wing tips. National markings in six positions

Dassault-Breguet/Dornier Alpha Jet E, E118/314-LN, Armèe de l'Air, assigned to AJeTS (Belgian/French Advanced Jet Training School, Cazaux, 2009. Gris Bleu Foncé overall with all lettering in black. Dayglo wing and fin tips. National markings in six positions. AJeTS badge on fin

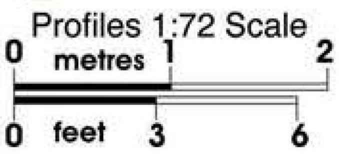
Dassault-Beguet/Dornier Alpha Jet B, AT20, Ecole de Pilotage Elementaire (EPE), Force Aérienne Belge. Dark Green FS.34079, Medium Green FS.34012 and Tan FS.30219 upper surfaces with Grey FS.36622 undersides. Codes on fin in white. Dayglo fin and wing tips. National markings in six positions



Dassault-Beguet/Dornier Alpha Jet B, AT24, No.11 Squadron, Force Aérienne Belge. Grey FS.26118 upper surfaces with leading edges to all flying surfaces in Dark Admiralty Grey; Light Grey FS.26375 undersides. Codes on fin and forward fuselage in white. Dayglo fin and wing tips. National markings in six positions. Unit badge on fin

Above: Dassault-Breguet/Dornier Alpha Jet TJ-CXI, Cameroon Air Force. Dark brown and sand wrap-around camouflage. All lettering in black. National markings in six positions

Dassault-Beguet/Dornier Alpha Jet MS.1, 3502, Egyptian Air Force. Dark Brown, Green and Tan upper surfaces with Pale Blue undersides. Lettering in black. National markings in six positions



Dassault-Beguet/Dornier Alpha Jet A, 15223, Esquadra 103 / Esquadra 301, Beja AB, Força Aérea Portuguesa, 1994. Norm 72 camouflage consisting of Bassaltgrau RAL 7012 and Gelboliv RAL 6014 upper surfaces with Silbergrau RAL 9006 undersides; Luftwaffe markings overpainted in matching paints. National marking on rear fuselage only. Serial on fin in black above green/red fin flash

Dassault-Beguet/Dornier Alpha Jet A, 15244, Esquadra 103 / Esquadra 301, Beja AB, Força Aérea Portuguesa, 1995. Norm 83B camouflage consisting of RAL 6003 and RAL 7021 wrap-around camouflage; Luftwaffe markings overpainted in matching paints. National marking on rear fuselage only. Serial on fin in black above green/red fin flash

Below and Left: Dassault-Beguet/Dornier Alpha Jet A, 15226, Esquadra 103 / Esquadra 301, Beja AB, Força Aérea Portuguesa, 2008. Wrap-around camouflage in Dark Green FS.34079, Medium Green FS.34012 and Tan FS.30219. Serial on fin in black above green/red fin flash. National markings on rear fuselage only

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Profiles 1:72 Scale
0 metres 1 2
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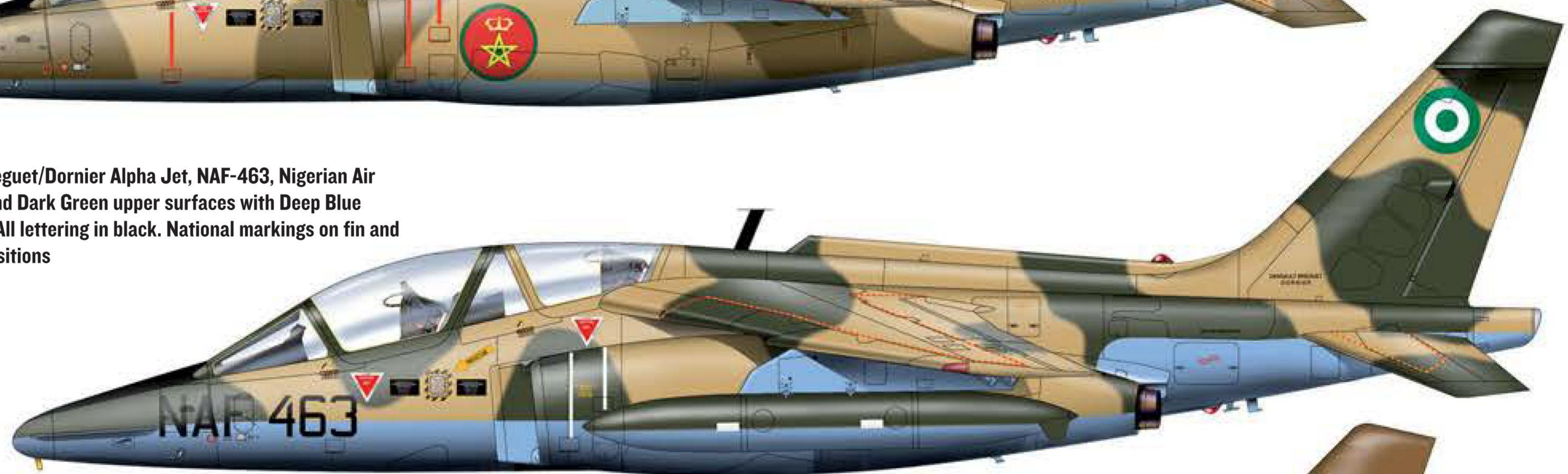
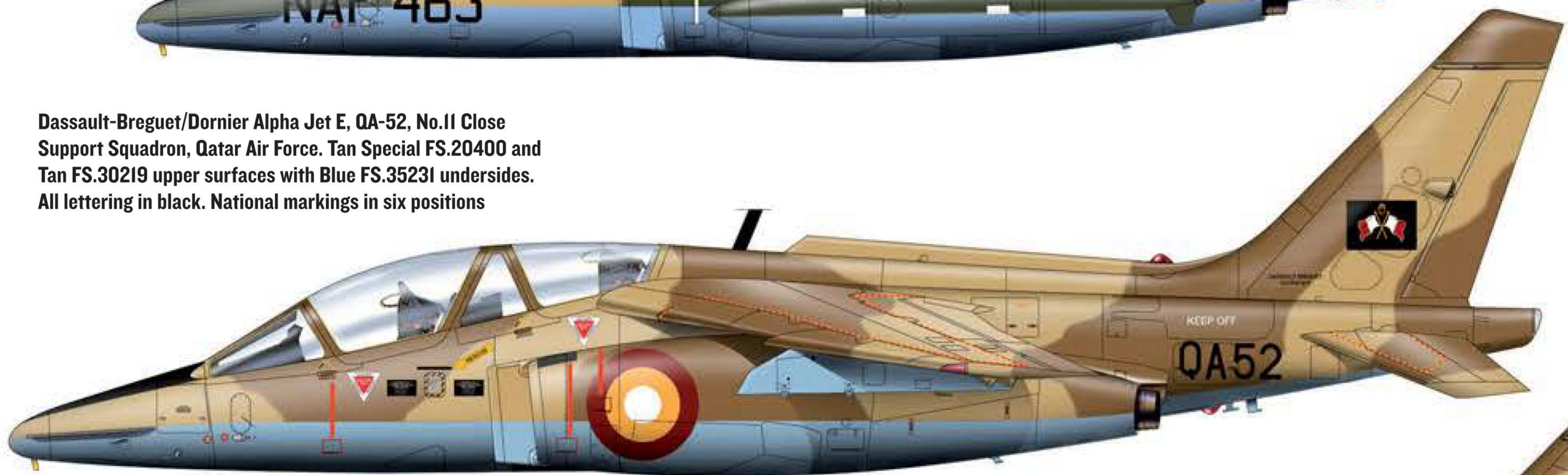
Dassault-Breguet/Dornier Alpha Jet H, '246', Royal Moroccan Air Force. Sand and brown upper surfaces with deep blue undersides. Black serial on fin. National markings in six positions

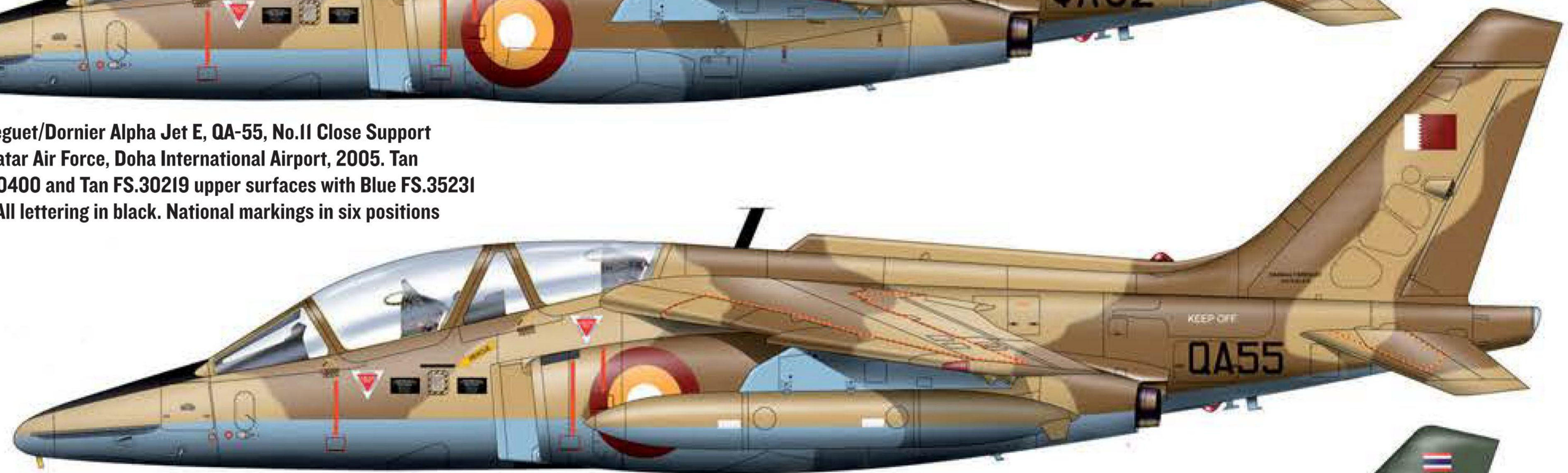
Dassault-Breguet/Dornier Alpha Jet, NAF-463, Nigerian Air Force. Tan and Dark Green upper surfaces with Deep Blue undersides. All lettering in black. National markings on fin and four wing positions



Dassault-Breguet/Dornier Alpha Jet E, QA-52, No.11 Close Support Squadron, Qatar Air Force. Tan Special FS.20400 and Tan FS.30219 upper surfaces with Blue FS.35231 undersides. All lettering in black. National markings in six positions



Dassault-Breguet/Dornier Alpha Jet E, QA-55, No.11 Close Support Squadron, Qatar Air Force, Doha International Airport, 2005. Tan Special FS.20400 and Tan FS.30219 upper surfaces with Blue FS.35231 undersides. All lettering in black. National markings in six positions



Dassault-Beguet/Dornier Alpha Jet A, 23124, No.231 Squadron, No.23 Wing, Royal Thai Air Force. Norm 83B wrap-around camouflage in Schwarzgrau RAL 7021 and Forest Green FS.34079. Codes in black. Unit badge on fin. No wing markings; fin flash high on fin tip

Dassault-Breguet/Dornier Alpha Jet 5V-MBC/BC, Togo Air Force. Dark brown, dark green and sand upper surfaces with pale grey undersides. All lettering in black. National markings in six positions

Profiles 1:72 Scale
0 metres 1 2
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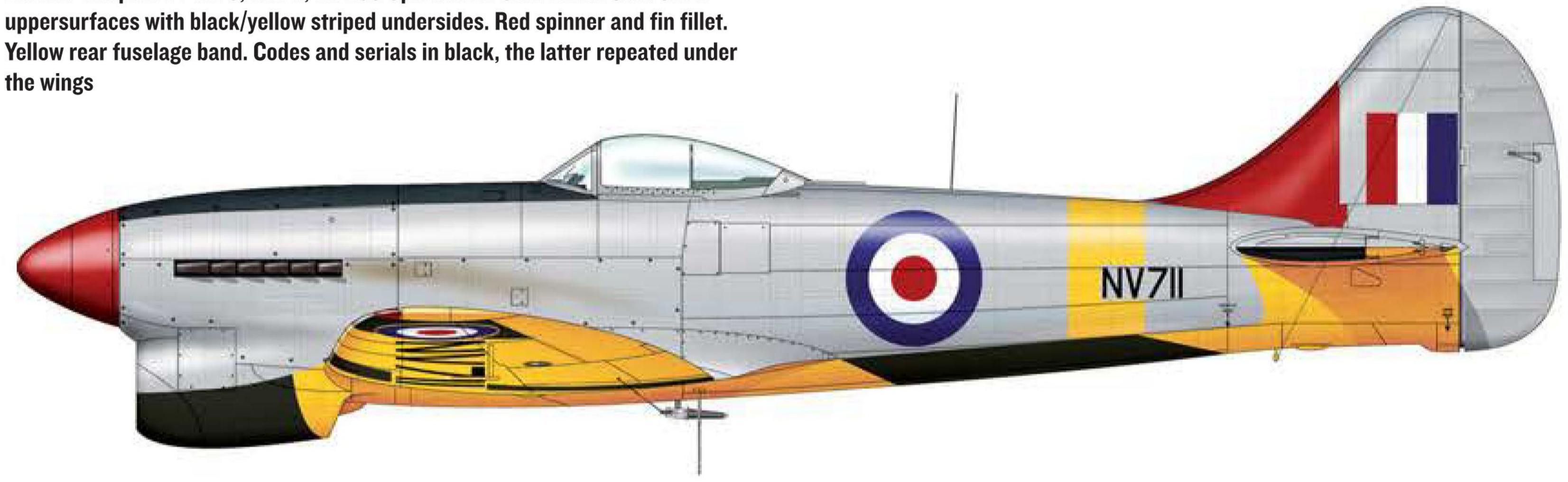
ANTI-CAMOUFLAGE 6

TEMPEST TARGET TUGS

Hawker Tempest TT Mk 5, NV711, No 233 Operational Conversion Unit. Silver uppersurfaces with black/yellow striped undersides. Red spinner and fin fillet. Yellow rear fuselage band. Codes and serials in black, the latter repeated under the wings



Hawker Tempest TT Mk 5, EJ880, • B, Armament Practice Station, Sylt, 1953. Silver uppersurfaces with black/yellow striped undersides. Red spinner and fin fillet. Yellow rear fuselage band. Codes and serials in black, the latter repeated under the wings

Hawker Tempest TT Mk 5, EJ660, RS•30, No 229 Operational Conversion Unit, Chivenor, 1953. Silver uppersurfaces with black/yellow striped undersides. Black spinner and anti-dazzle panel. Yellow rear fuselage band. Codes and serials in black, the latter repeated under the wings. Converted from a Tempest Mk V (JF•E, No.3 Squadron) which was flown by F/O Off Vassilios "Vass" Vassiliades who on 23rd January 1945 shot down two Fw 190s and damaged a third

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Hawker Tempest TT Mk 5, SN354, RS•24, No. 229 Operational Conversion Unit, Devon, 1953. Aluminium paint overall with yellow/black striped undersurfaces; black anti-dazzle panel, spinner and all lettering

Hawker Tempest TT Mk 5, SN274, WH•13, APC Acklington. Silver uppersurfaces with black/yellow striped undersides; red spinner and yellow rear fuselage band. Codes and serials in black, the latter repeated under the wings

Profiles 1:72 Scale
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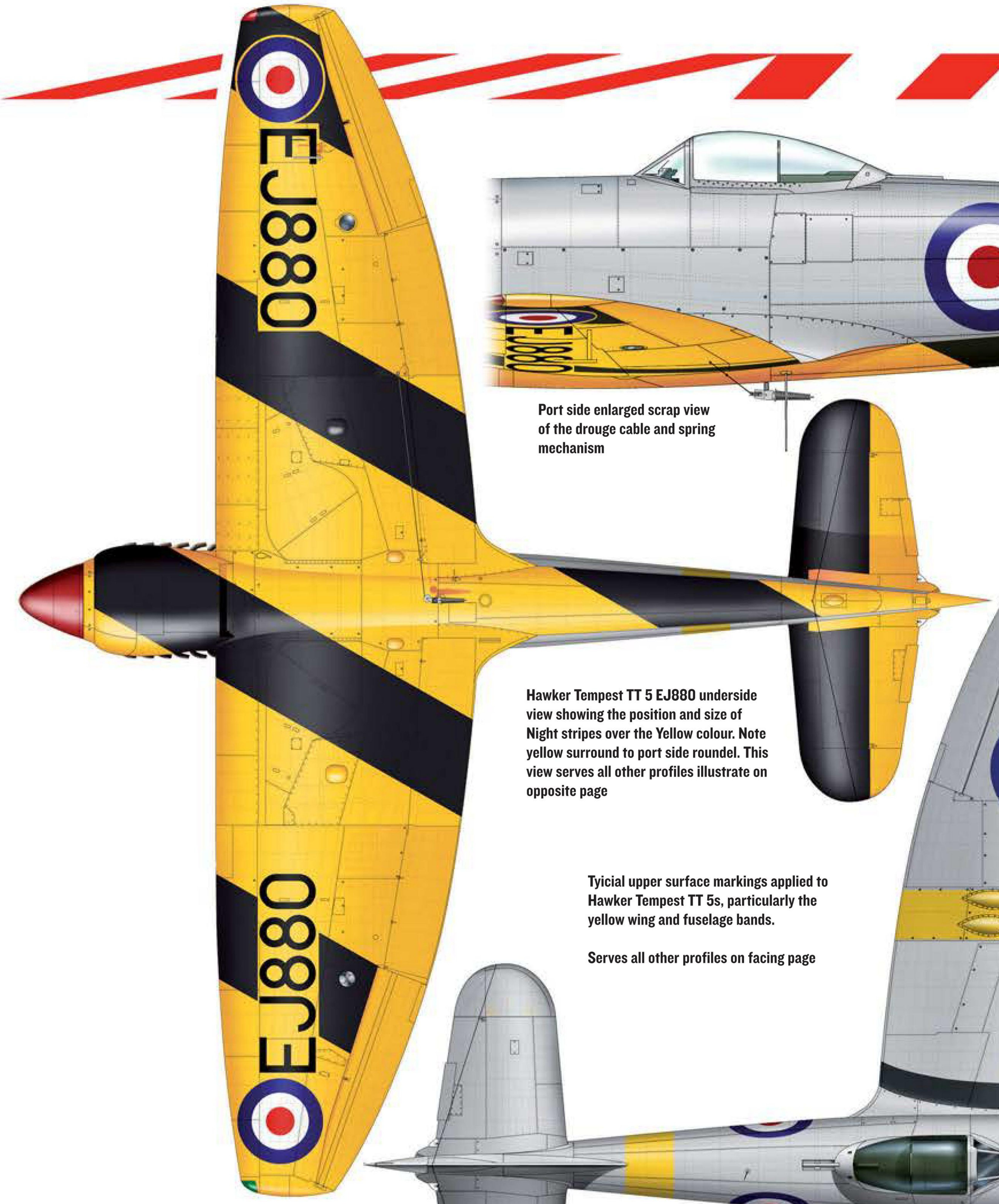

Port side enlarged scrap view of the drouge cable and spring mechanism

1:72 Scale
0 metres 1 2
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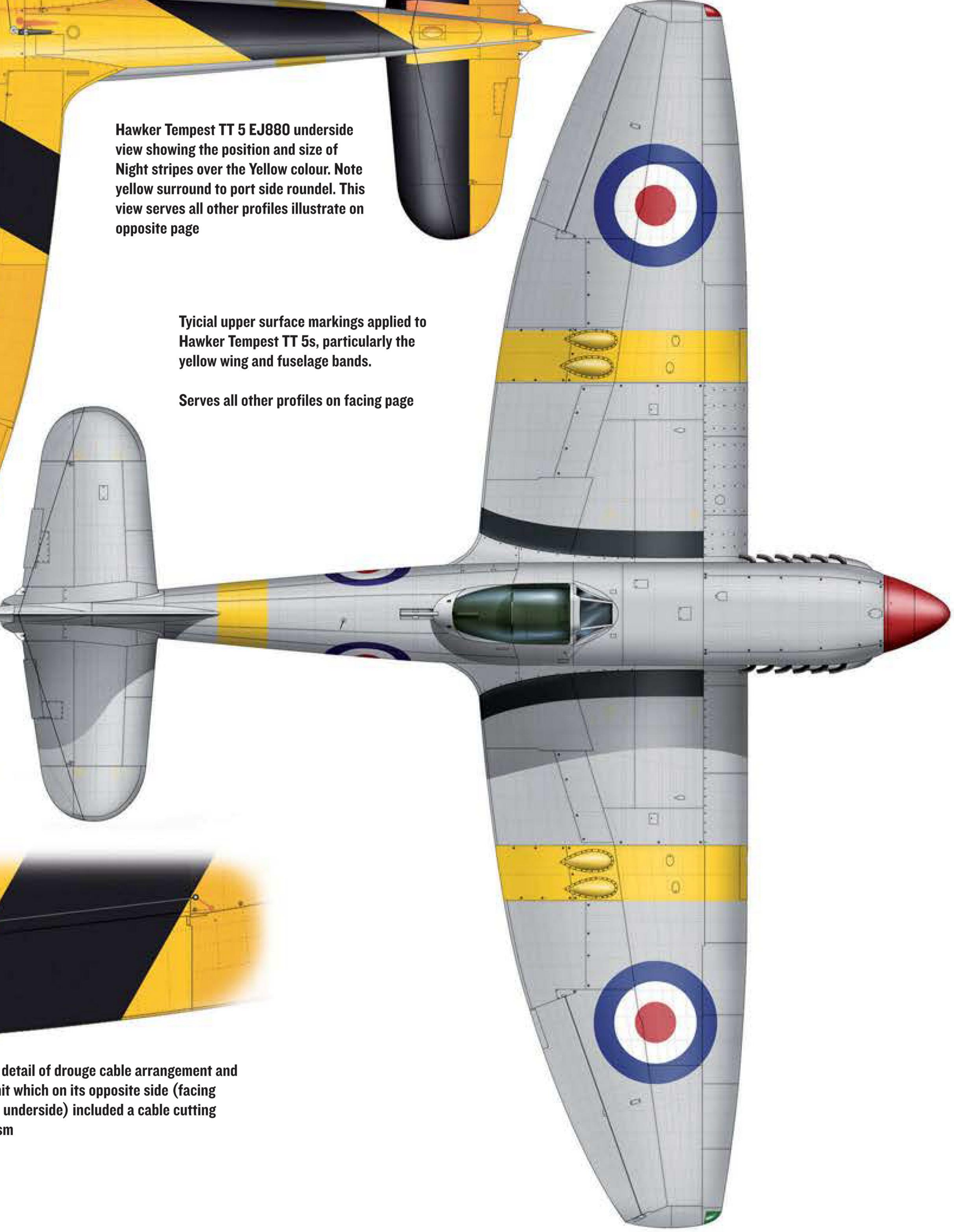
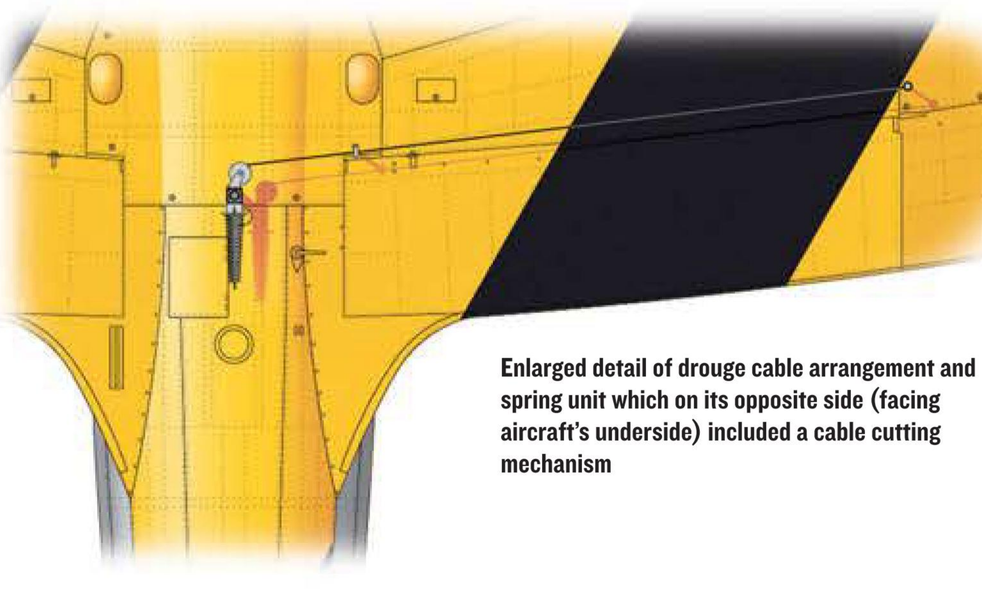
Hawker Tempest TT 5 EJ880 underside view showing the position and size of Night stripes over the Yellow colour. Note yellow surround to port side roundel. This view serves all other profiles illustrate on opposite page



Tyicial upper surface markings applied to Hawker Tempest TT 5s, particularly the yellow wing and fuselage bands.

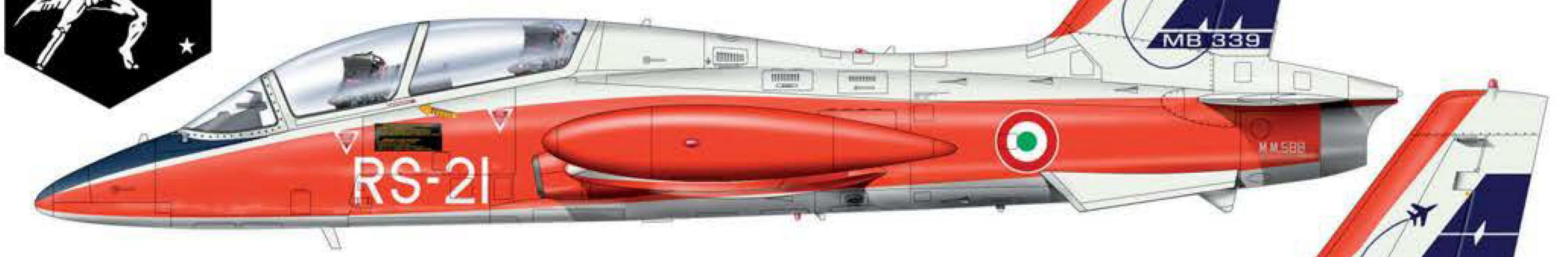
Serves all other profiles on facing page



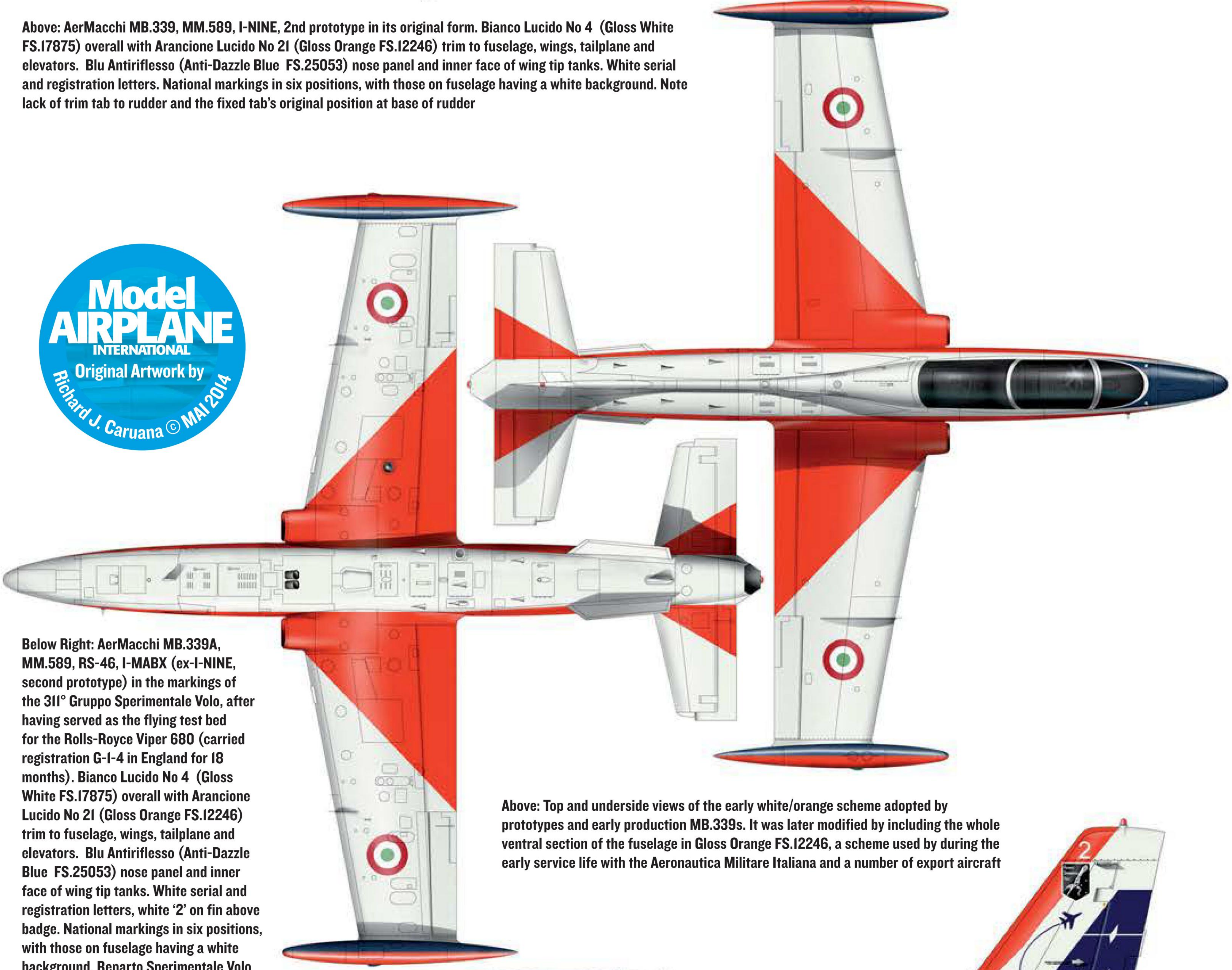
Enlarged detail of drouge cable arrangement and spring unit which on its opposite side (facing aircraft's underside) included a cable cutting mechanism

Aermacchi MB 339

AerMacchi MB.339A, MM.588, RS-21 (ex-I-NOVE, the first prototype) as it appeared in spring of 1982, just before it was taken out of service (June 1982). Bianco Lucido No 4 (Gloss White FS.17875) overall with Arancione Lucido No 21 (Gloss Orange FS.12246) trim to fuselage, wings, tailplane and elevators. Blu Antiriflesso (Anti-Dazzle Blue FS.25053) nose panel and inner face of wing tip tanks. White serial and registration letters. National markings in six positions, with those on fuselage having a white background. Reparto Sperimentale Volo (Experimental Flight Unit) badge on fin. For some time it carried both civil and military registrations



Above: AerMacchi MB.339, MM.589, I-NINE, 2nd prototype in its original form. Bianco Lucido No 4 (Gloss White FS.17875) overall with Arancione Lucido No 21 (Gloss Orange FS.12246) trim to fuselage, wings, tailplane and elevators. Blu Antiriflesso (Anti-Dazzle Blue FS.25053) nose panel and inner face of wing tip tanks. White serial and registration letters. National markings in six positions, with those on fuselage having a white background. Note lack of trim tab to rudder and the fixed tab's original position at base of rudder



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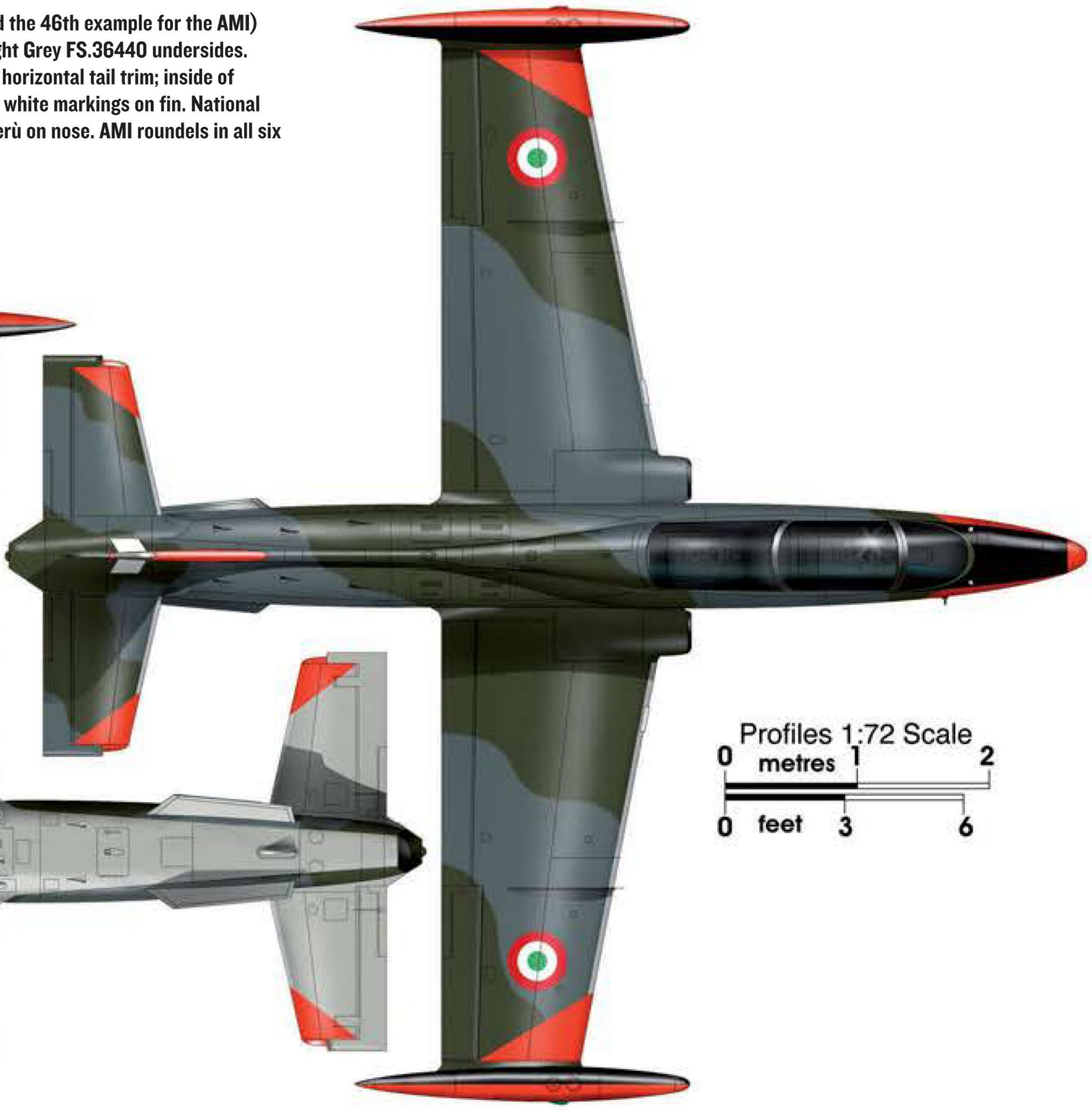
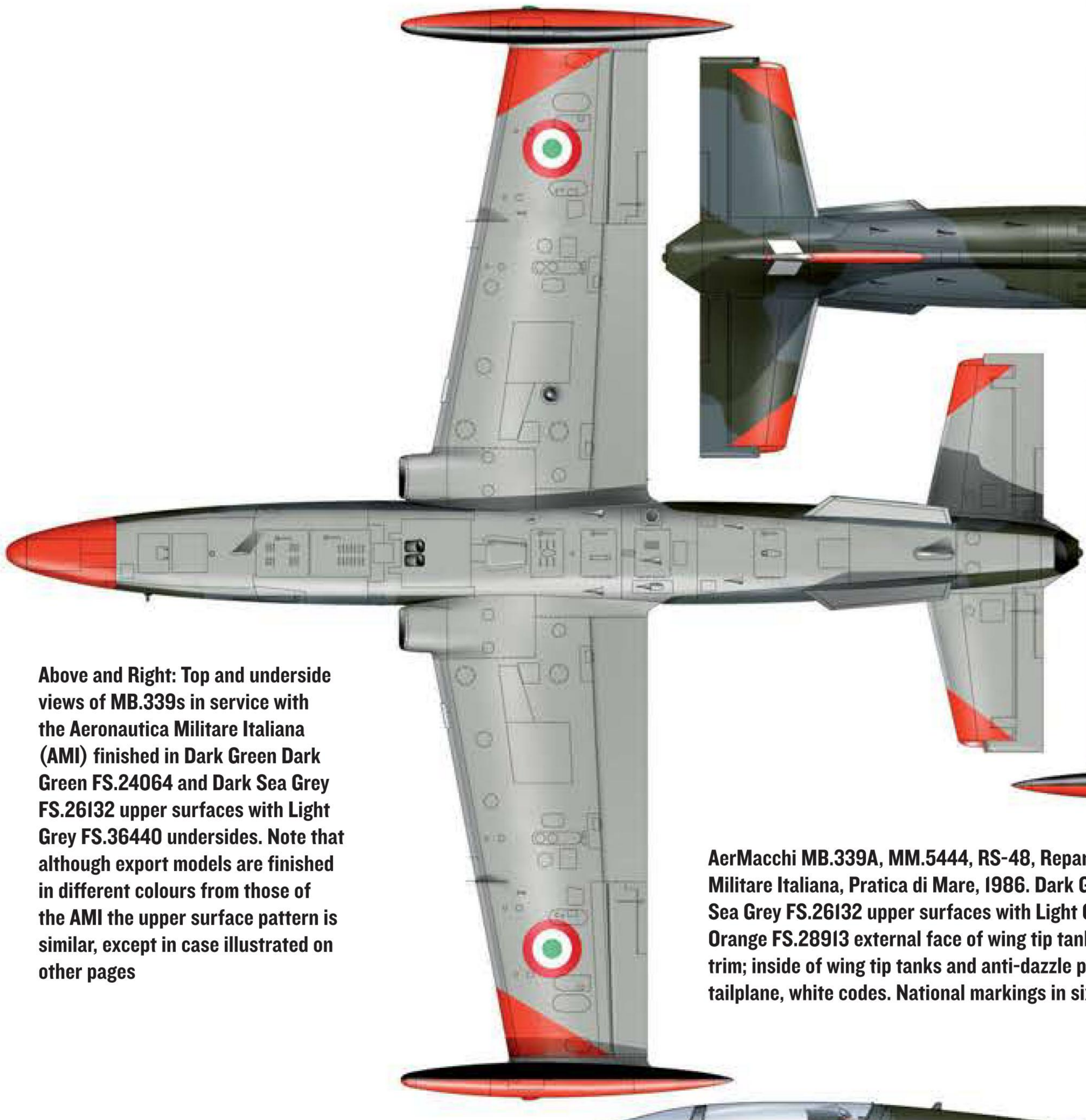
Below Right: AerMacchi MB.339A, MM.589, RS-46, I-MABX (ex-I-NINE, second prototype) in the markings of the 311° Gruppo Sperimentale Volo, after having served as the flying test bed for the Rolls-Royce Viper 680 (carried registration G-1-4 in England for 18 months). Bianco Lucido No 4 (Gloss White FS.17875) overall with Arancione Lucido No 21 (Gloss Orange FS.12246) trim to fuselage, wings, tailplane and elevators. Blu Antiriflesso (Anti-Dazzle Blue FS.25053) nose panel and inner face of wing tip tanks. White serial and registration letters, white '2' on fin above badge. National markings in six positions, with those on fuselage having a white background. Reparto Sperimentale Volo (Experimental Flight Unit) badge on fin. For some time it carried both civil and military registrations

Above: Top and underside views of the early white/orange scheme adopted by prototypes and early production MB.339s. It was later modified by including the whole ventral section of the fuselage in Gloss Orange FS.12246, a scheme used by during the early service life with the Aeronautica Militare Italiana and a number of export aircraft

AerMacchi MB.339A, MM.54450, 14•30, 8° Gruppo, 14° Stormo Aeronautica Militare Italiana, Pratica di Mare, 1982. Bianco Lucido No 4 (Gloss White FS.17875) overall with Arancion Lucido No 21 (Gloss Orange FS.12246) trim to all undersides, wings, tailplane and elevators (unofficially referred to as 'Marlboro' scheme). Blu Antiriflesso (Anti-Dazzle Blue FS.25053) nose panel and inner face of wing tip tanks. Black codes and serials. National markings in six positions, with those on fuselage having a white background. 14º Stormo badge on fin, 8º Gruppo badge on nose

Above: AerMacchi MB.339A, MM.54498, the 100th example produced (and the 46th example for the AMI) Dark Green FS.24064 and Dark Sea Grey FS.26132 upper surfaces with Light Grey FS.36440 undersides. Dayglo Orange FS.28913 external face of wing tip tanks, nose, vertical and horizontal tail trim; inside of wing tip tanks and anti-dazzle panels in black. Black serial below tailplane, white markings on fin. National markings in six positions. AMI, Frecce Tricolori, Argentina, Malaysia and Perù on nose. AMI roundels in all six positions





Profiles 1:72 Scale
0 metres 1 2
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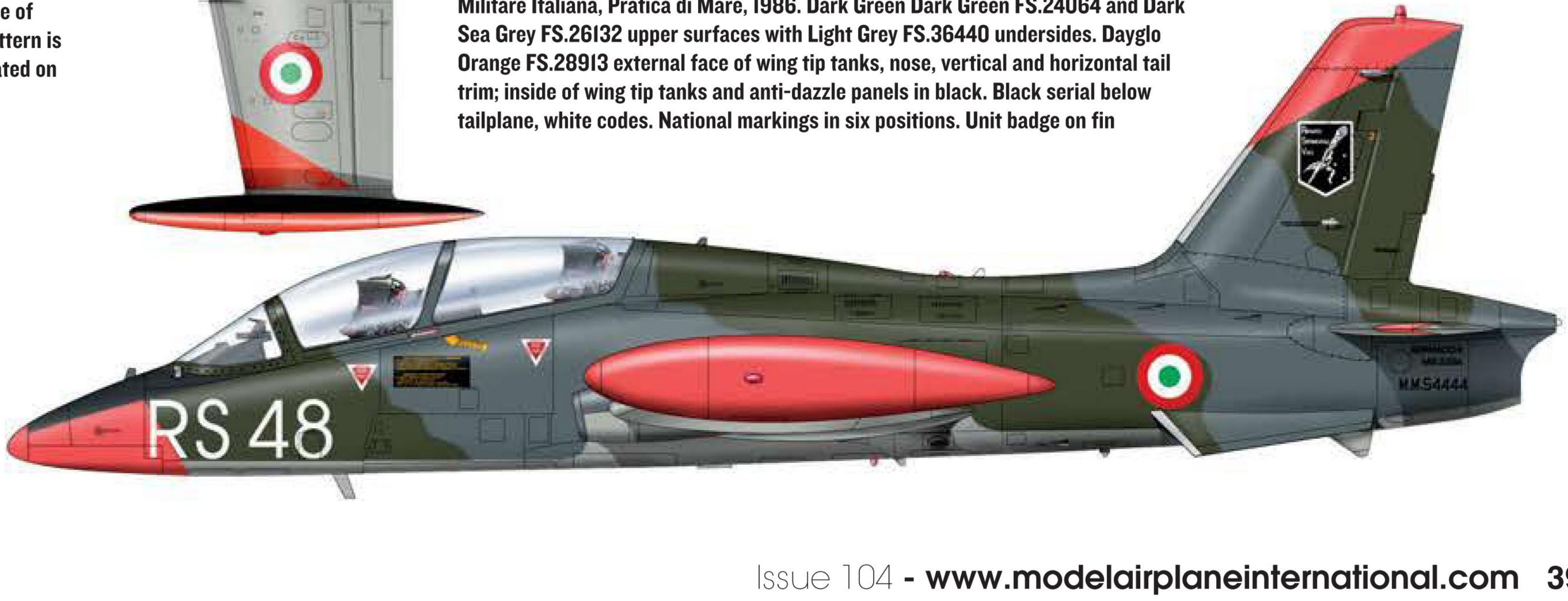
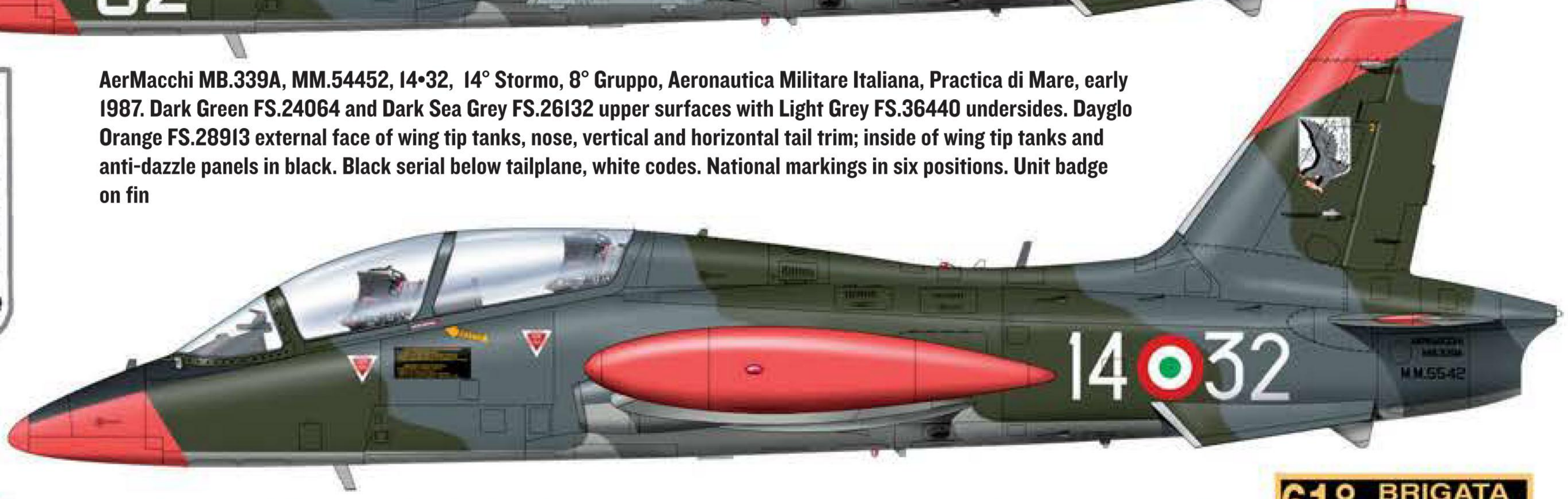
Above and Right: Top and underside views of MB.339s in service with the Aeronautica Militare Italiana (AMI) finished in Dark Green Dark Green FS.24064 and Dark Sea Grey FS.26132 upper surfaces with Light Grey FS.36440 undersides. Note that although export models are finished in different colours from those of the AMI the upper surface pattern is similar, except in case illustrated on other pages

AerMacchi MB.339A, MM.5444, RS-48, Reparto Sperimentale Volo, Aeronautica Militare Italiana, Pratica di Mare, 1986. Dark Green Dark Green FS.24064 and Dark Sea Grey FS.26132 upper surfaces with Light Grey FS.36440 undersides. Dayglo Orange FS.28913 external face of wing tip tanks, nose, vertical and horizontal tail trim; inside of wing tip tanks and anti-dazzle panels in black. Black serial below tailplane, white codes. National markings in six positions. Unit badge on fin

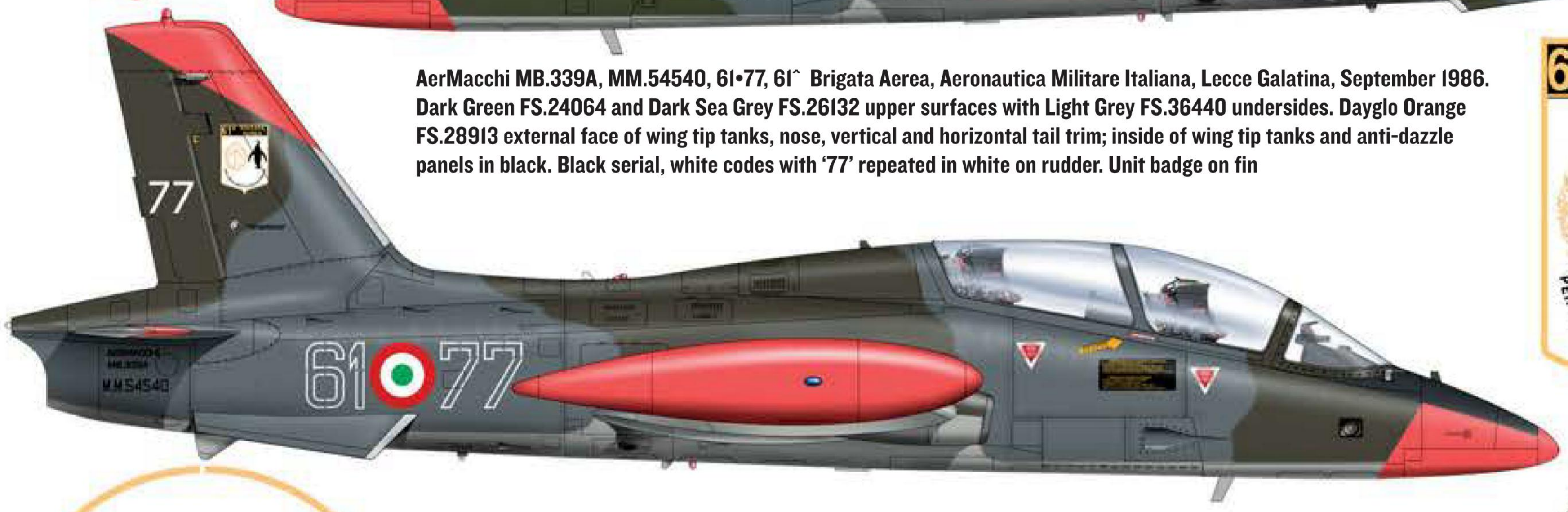


AerMacchi MB.339A, MM.54504, 'White 52', Scuola Volo Basico Iniziale Aviogetti. Dark Green FS.34079 and Dark Sea Grey FS.36132 upper surfaces with Light Grey FS.36440 undersides. Dayglo Orange FS.12199 external face of wing tip tanks, nose, vertical and horizontal tail trim; inside of wing tip tanks and anti-dazzle panels in black. Black serial, white codes. Unit badge on fin

AerMacchi MB.339A, MM.54452, 14•32, 14° Stormo, 8° Gruppo, Aeronautica Militare Italiana, Practica di Mare, early 1987. Dark Green FS.24064 and Dark Sea Grey FS.26132 upper surfaces with Light Grey FS.36440 undersides. Dayglo Orange FS.28913 external face of wing tip tanks, nose, vertical and horizontal tail trim; inside of wing tip tanks and anti-dazzle panels in black. Black serial below tailplane, white codes. National markings in six positions. Unit badge on fin

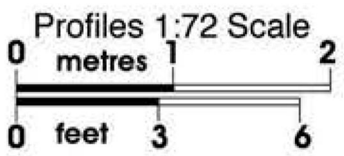


AerMacchi MB.339A, MM.54540, 61•77, 61^ Brigata Aerea, Aeronautica Militare Italiana, Lecce Galatina, September 1986. Dark Green FS.24064 and Dark Sea Grey FS.26132 upper surfaces with Light Grey FS.36440 undersides. Dayglo Orange FS.28913 external face of wing tip tanks, nose, vertical and horizontal tail trim; inside of wing tip tanks and anti-dazzle panels in black. Black serial, white codes with '77' repeated in white on rudder. Unit badge on fin



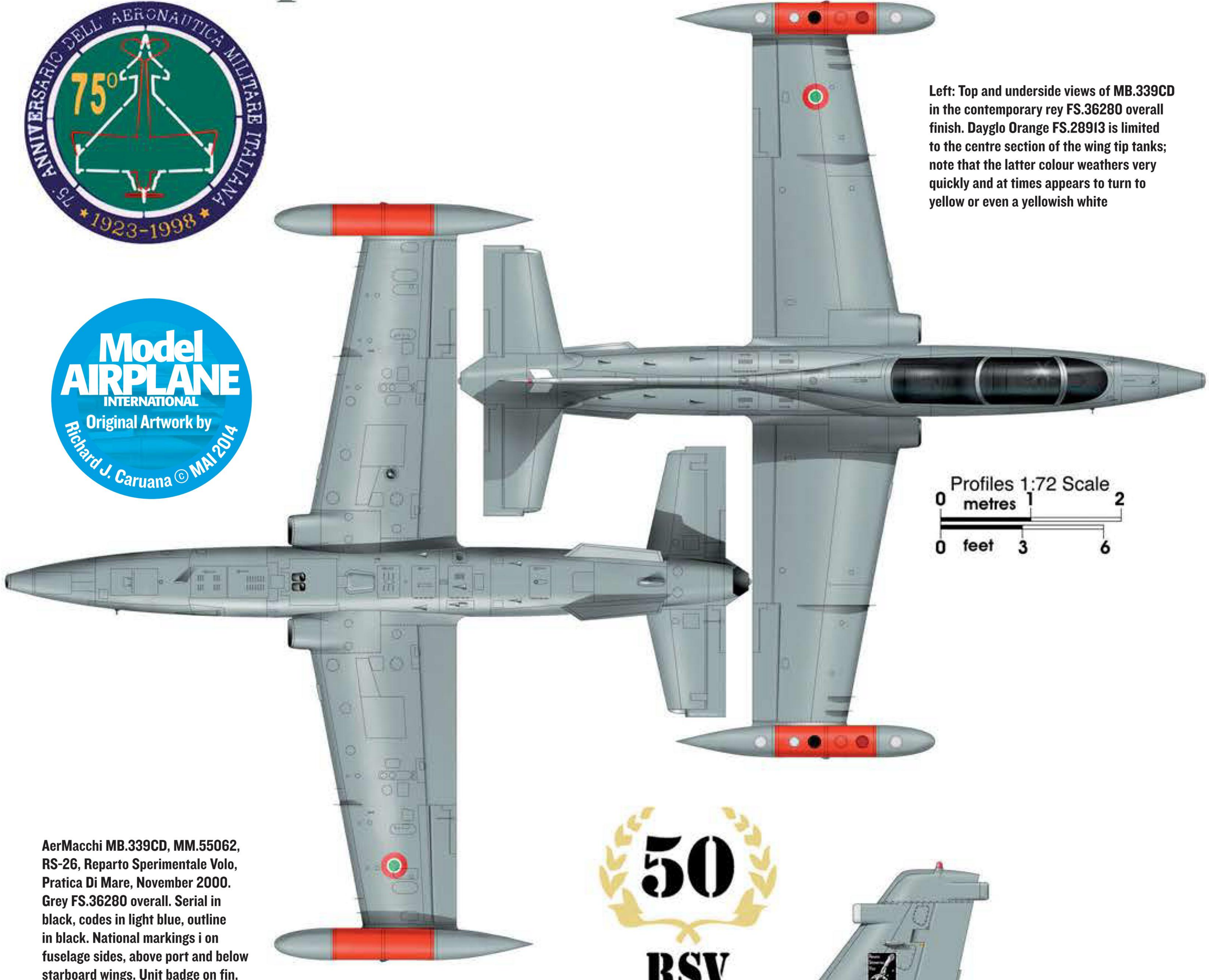
AerMacchi MB.339A, MM.54447, 61•02, 61^ Brigata Aerea, Aeronautica Militare Italiana, Lecce Galatina, September 1993. Dark Green FS.24064 and Dark Sea Grey FS.26132 upper surfaces with Light Grey FS.36440 undersides. Dayglo Orange FS.28913 band on wing tip tanks. Black serial, light blue codes thinly outlined in black. Roundels in six positions. Unit badge on fin

AerMacchi MB.339A, MM.54541, RS-27, Reparto Sperimentale Volo (311° Gruppo, Aeronautica Militare Italiana, Pratica di Mare. Dark Green FS.24064 and Dark Sea Grey FS.26132 upper surfaces with Light Grey FS.36440 undersides. Dayglo Orange FS.28913 external face of wing tip tanks, nose, vertical and horizontal tail trim; inside of wing tip tanks and anti-dazzle panels in black. Black serial below tailplane, light blue codes thinly outlined in black. National markings in six positions. Unit badge on fin



AerMacchi MB.339A, MM.54508, 61•56, 61^ Brigata Aerea, Lecce Galatina, Aeronautica Militare Italiana. Tactical Grey FS.36280 overall with national markings in six positions. Serial in black. Codes in light blue, thinly outlined in black. Scuola Volo Basico Avanzato (SVBA) badge on fin

AerMacchi MB.339CD, MM.55066, 61•132, 61^ Brigata Aerea, Aeronautica Militare Italiana, Lecce Galatina, 1998. Grey FS.36280 overall. Serial in black, codes in light blue, outline in black. National markings on fuselage sides, above port and below starboard wings. SVBA badge on fin, 75th Italian Air Force Anniversary badge above the air intake



Left: Top and underside views of MB.339CD in the contemporary rey FS.36280 overall finish. Dayglo Orange FS.28913 is limited to the centre section of the wing tip tanks; note that the latter colour weathers very quickly and at times appears to turn to yellow or even a yellowish white

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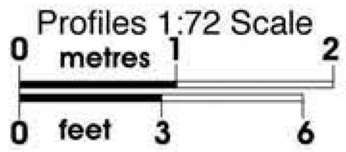
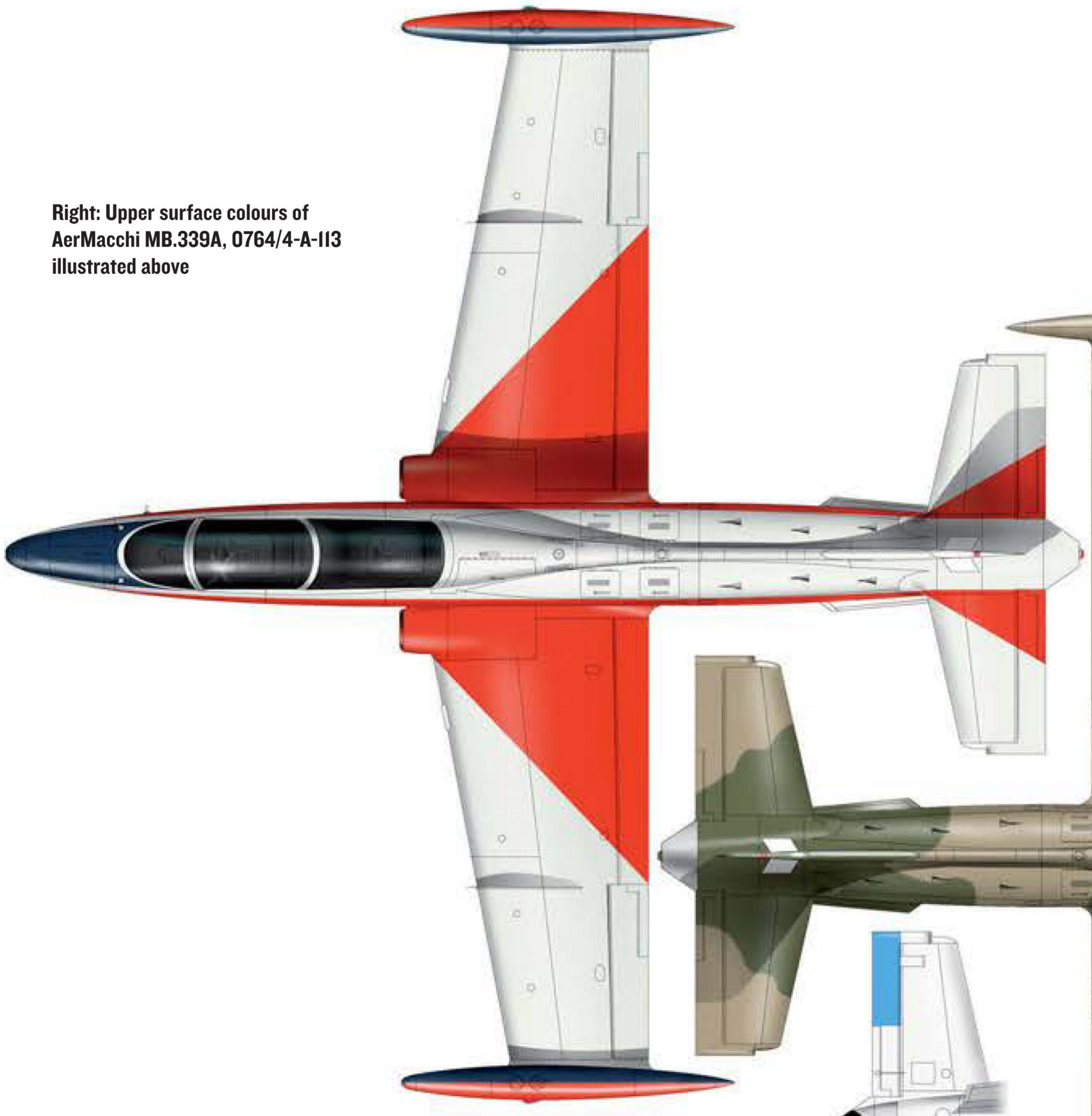
AerMacchi MB.339CD, MM.55062, RS-26, Reparto Sperimentale Volo, Pratica Di Mare, November 2000. Grey FS.36280 overall. Serial in black, codes in light blue, outline in black. National markings i on fuselage sides, above port and below starboard wings. Unit badge on fin, 50th RSV Anniversary log at base of fin

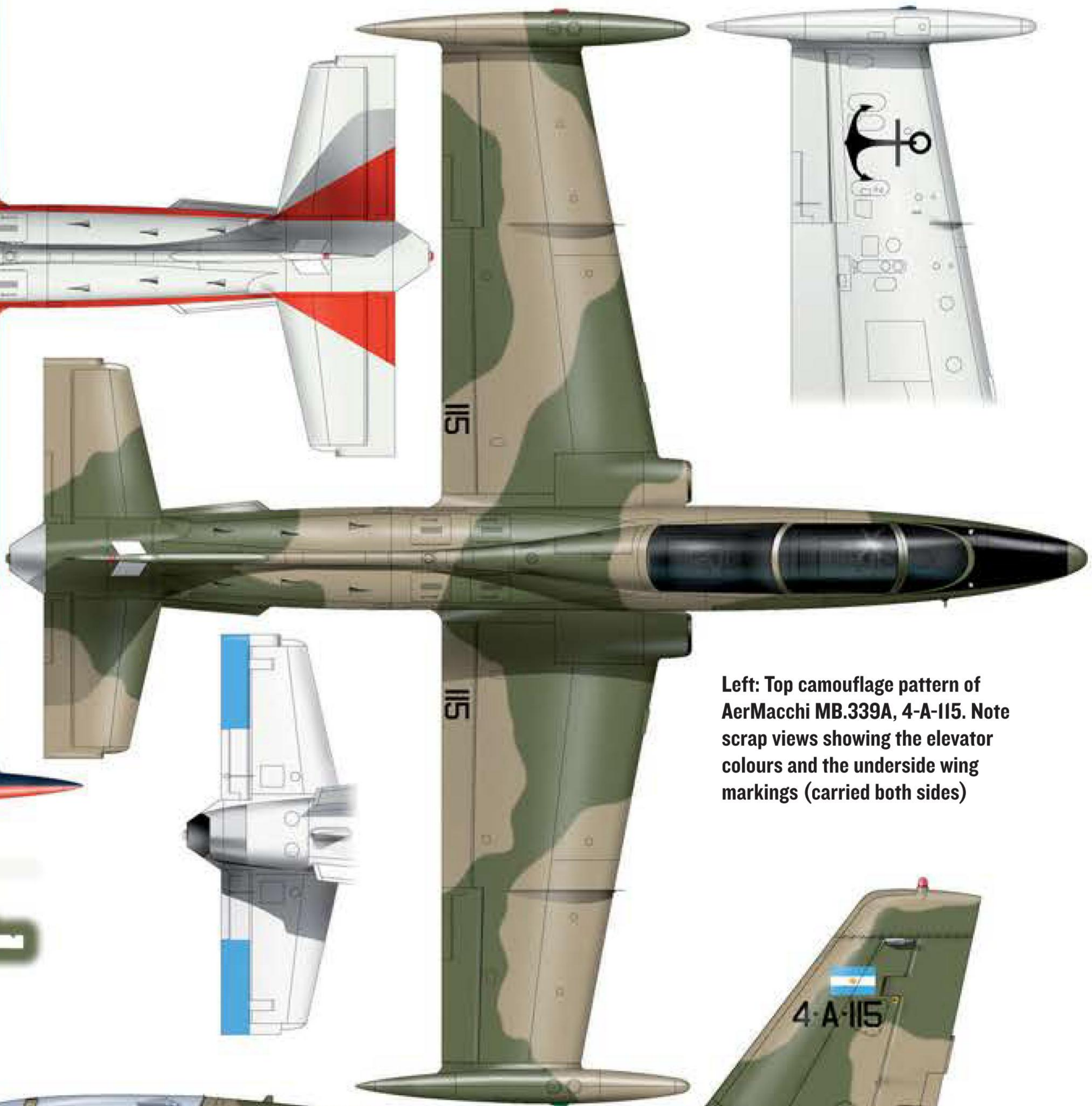
AerMacchi MB.339CD, MM.55085, 61•155, 61^ Aeronautica Militare Italiana, Brigata Aerea, Lecce Galatina, 2011. Grey FS.36280 overall. Serial in black, codes in light blue, thinly outline in stencilled black. on fuselage sides, above port and below starboard wings. SVBA badge on fin

AerMacchi MB.339A, 0764/4-A-113, Comando de Aviacion Naval Argentina, Punta Indo Naval Base, November 1981. Gloss White FS.17875 overall with Gloss Orange FS.12246 trim to all undersides, wings, tailplane and elevators. Anti-Dazzle Blue FS.25053 nose panel and inner face of wing tip tanks. No wing markings. It was later camouflaged and was destroyed whilst operating from Puerto Argentino (Port Stanley) during the Falklands War, 1982





Right: Upper surface colours of AerMacchi MB.339A, 0764/4-A-113 illustrated above

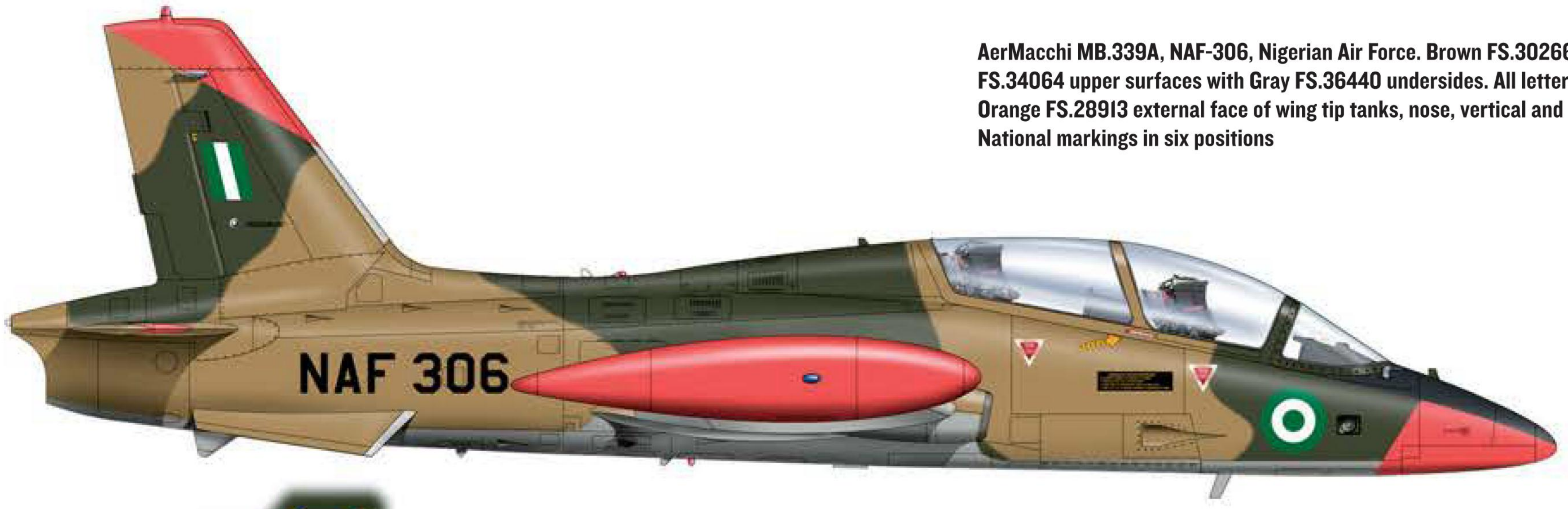


Left: Top camouflage pattern of AerMacchi MB.339A, 4-A-115. Note scrap views showing the elevator colours and the underside wing markings (carried both sides)

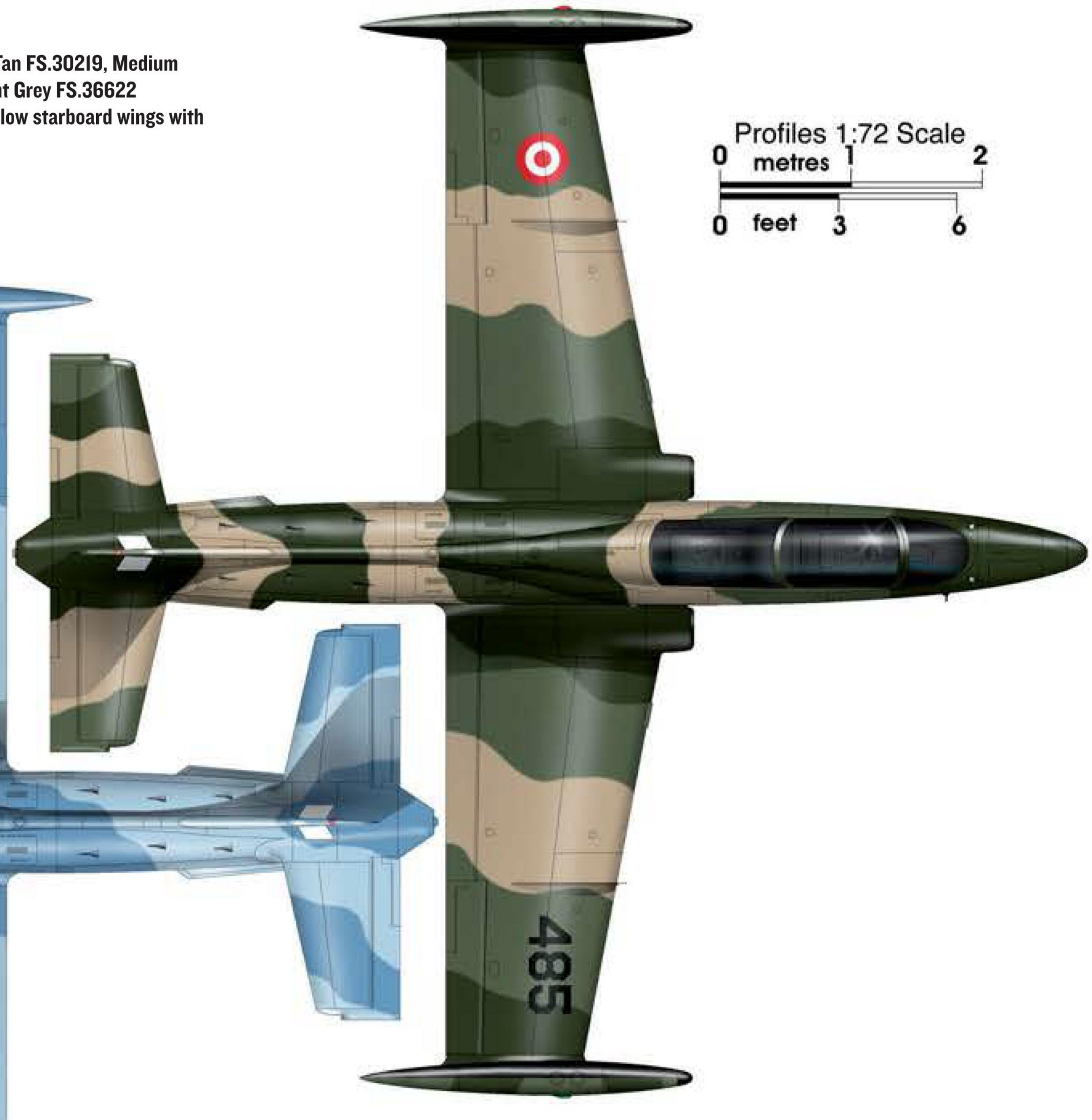
AerMacchi MB.339A, 0766/4-A-115, 1 Escuadrilla Aeronaval de Ataque, Comando de Aviacion Naval Argentina, flown by Owen Crippa., Falklands War, May 1982. Green FS.34127 and Brown FS.30318 upper surfaces with White FS.17675 undersides. All lettering in black. No markings above wings; black anchor markings below wings. Unit badge on nose. Note 'hit' marking denoting the attack of 21st May 1982 on the frigate HMS Argonaut

MB.339A, G-802, Ghana Air Force. Brown FS.30266 and Dark Green FS.34064 upper surfaces with Grey FS.36440 undersides. All lettering in black. National markings in six positions

AerMacchi MB.339A, NAF-306, Nigerian Air Force. Brown FS.30266 and Dark Green FS.34064 upper surfaces with Gray FS.36440 undersides. All lettering in black. Dayglo Orange FS.28913 external face of wing tip tanks, nose, vertical and horizontal tail trim. National markings in six positions



Above & Right: AerMacchi MB.339AP, 485, Fuerza Aérea del Perú. Tan FS.30219, Medium Green FS.34102 and Dark Green FS.34092 upper surfaces with Light Grey FS.36622 undersides. Lettering in black. National markings above port and below starboard wings with 485' in black repeated above starboard and below port wings



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Below & Left: AerMacchi MB.339AP, 487, Fuerza Aérea del Perú, 2011. Light Blue Grey overall with Dark Blue Grey on upper surfaces. National markings above port and below starboard wings; '487' in black on fin and above starboard and below port wings

AerMacchi MB.339A, M34-05, No 15 Squadron, Tentera Udara DiRaja Malaysia (Royal Malaysian Air Force-TUDM), Simpang, 2011. Brown FS.30266 and Dark Green FS.34064 upper surfaces with Grey FS.36440 undersides. All lettering in white, with '05' repeated on nose. National markings on fuselage sides, above port and below starboard wings. M34-05 repeated in white above starboard wing and in black below port wing. Panther head and blue/white/red flashes on rudder, both sides

Above: AerMacchi MB.339CE, ERAF-408, Eritrean Air Force. Sand Yellow RAL.1002 and Olive Green RAL.6003 upper surfaces with Light Grey RAL.7035 undersides. Lettering in black. National markings on fuselage sides, above port and below starboard wings. Note: photographs seem to indicate that a fin flash carried high on the fin and the roundel above the port wing were removed in service

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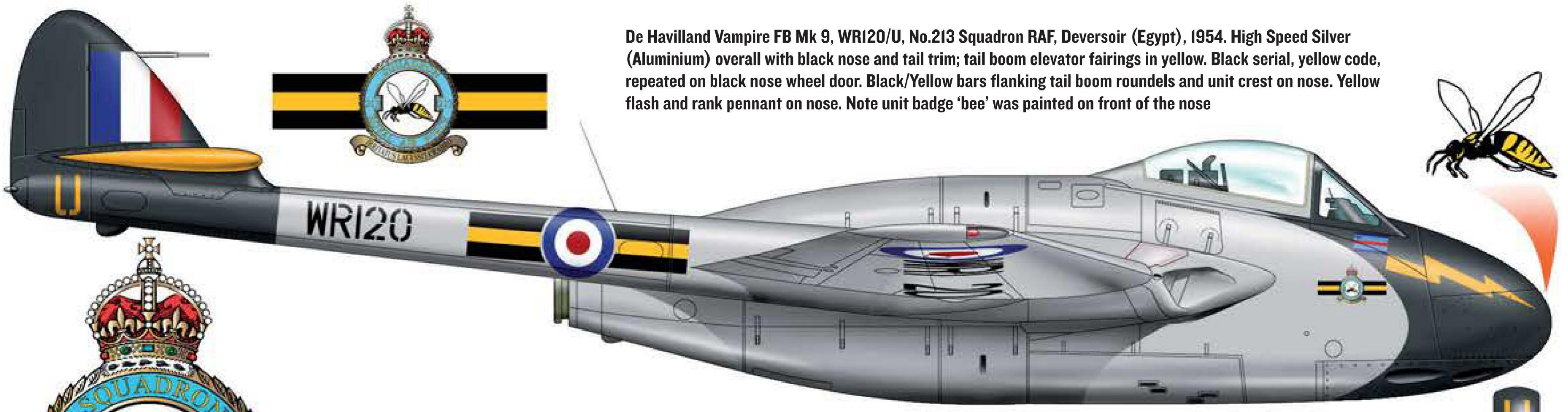
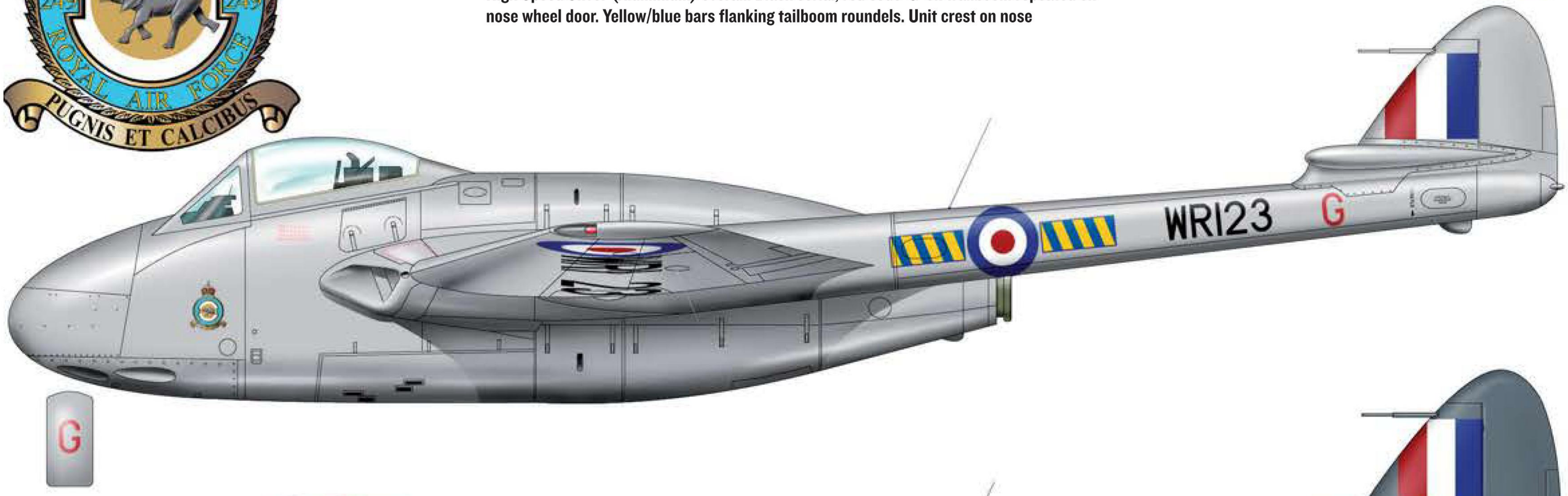
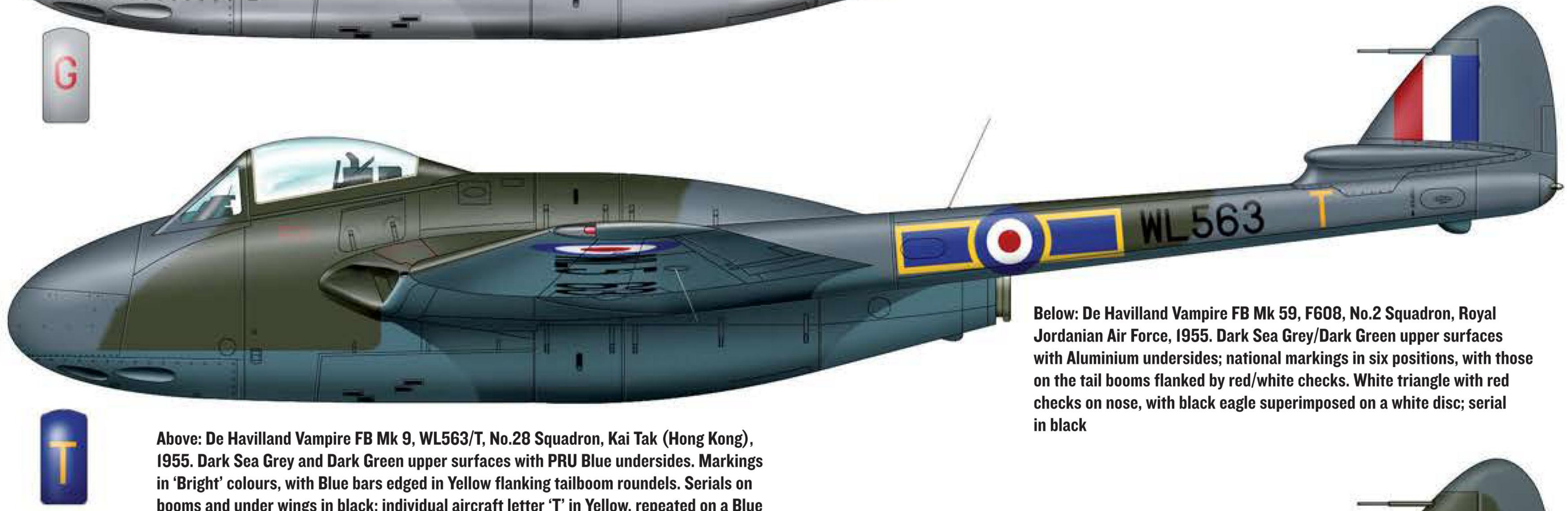
Above & Below: AerMacchi MB.339CB, NZ6470/70 (cn.6801), No.14 Squadron, Royal New Zealand Air Force, delivered in November 1992. Wrap-round camouflage in Light Green FS.34102, Dark Green FS.34079 and Grey FS.36081. National markings above port and below starboard wings, kiwi always facing inboard. National marking on fuselage sides flanked by black bars with white diamonds. All lettering in black. White Kiwi on black disk on fin



De Havilland Vampire FB Mk 9, WR120/U, No.213 Squadron RAF, Deversoir (Egypt), 1954. High Speed Silver (Aluminium) overall with black nose and tail trim; tail boom elevator fairings in yellow. Black serial, yellow code, repeated on black nose wheel door. Black/Yellow bars flanking tail boom roundels and unit crest on nose. Yellow flash and rank pennant on nose. Note unit badge 'bee' was painted on front of the nose

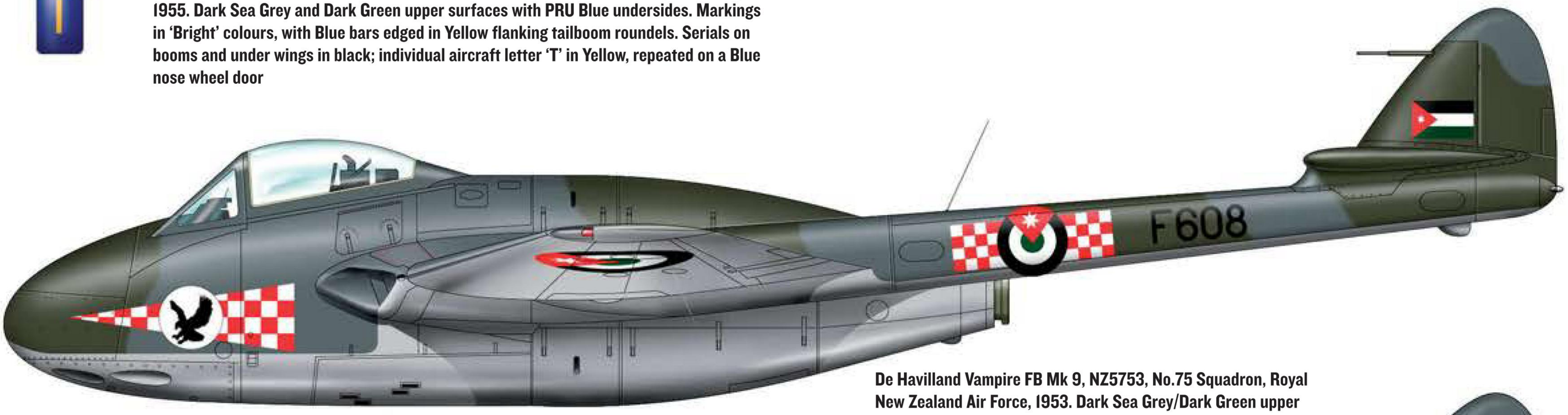
De Havilland Vampire FB Mk 9, WR123/G, No.249 Squadron RAF, Deversoir (Egypt), 1952. High Speed SIlver (Aluminium) overall. Black serial, red code 'G' on trailboom repeated on nose wheel door. Yellow/blue bars flanking tailboom roundels. Unit crest on nose



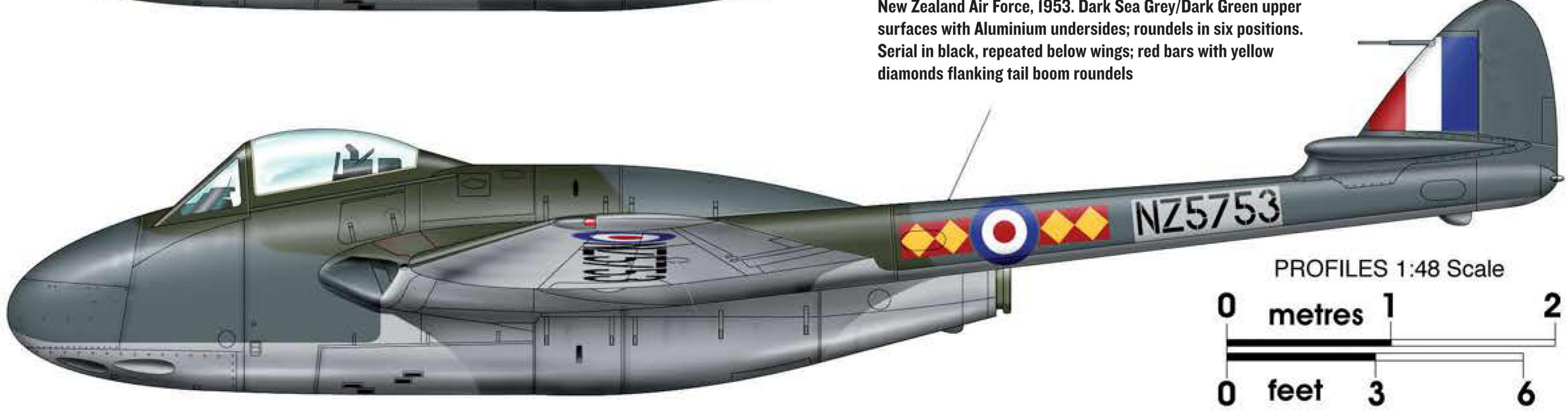


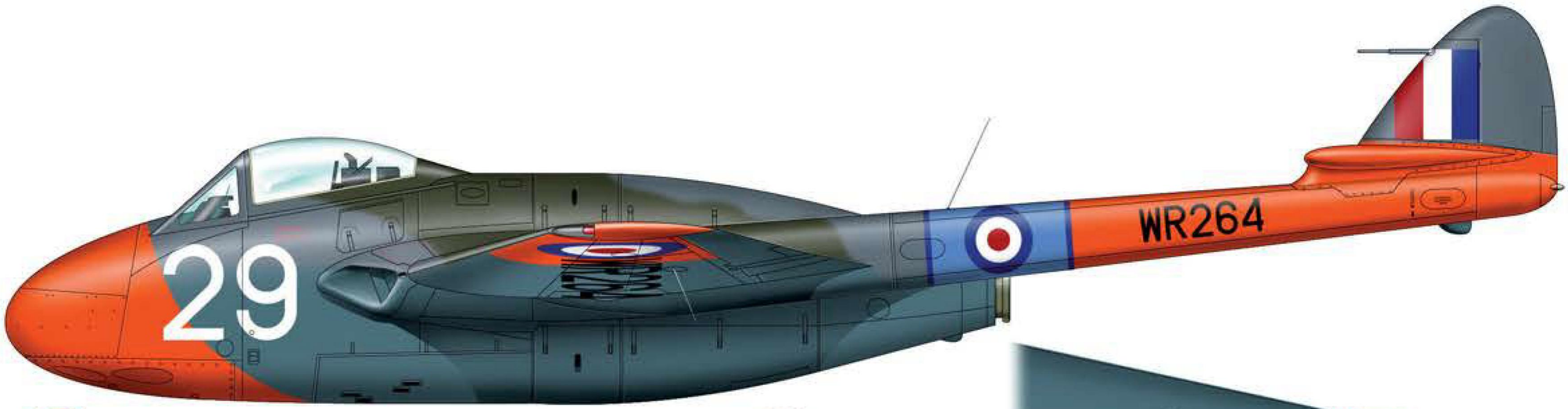
Above: De Havilland Vampire FB Mk 9, WL563/T, No.28 Squadron, Kai Tak (Hong Kong), 1955. Dark Sea Grey and Dark Green upper surfaces with PRU Blue undersides. Markings in 'Bright' colours, with Blue bars edged in Yellow flanking tailboom roundels. Serials on booms and under wings in black; individual aircraft letter 'T' in Yellow, repeated on a Blue nose wheel door

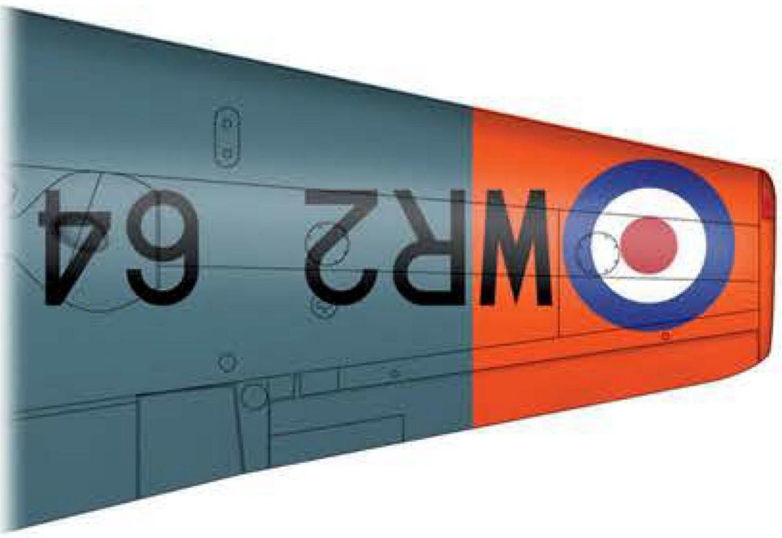
Below: De Havilland Vampire FB Mk 59, F608, No.2 Squadron, Royal Jordanian Air Force, 1955. Dark Sea Grey/Dark Green upper surfaces with Aluminium undersides; national markings in six positions, with those on the tail booms flanked by red/white checks. White triangle with red checks on nose, with black eagle superimposed on a white disc; serial in black



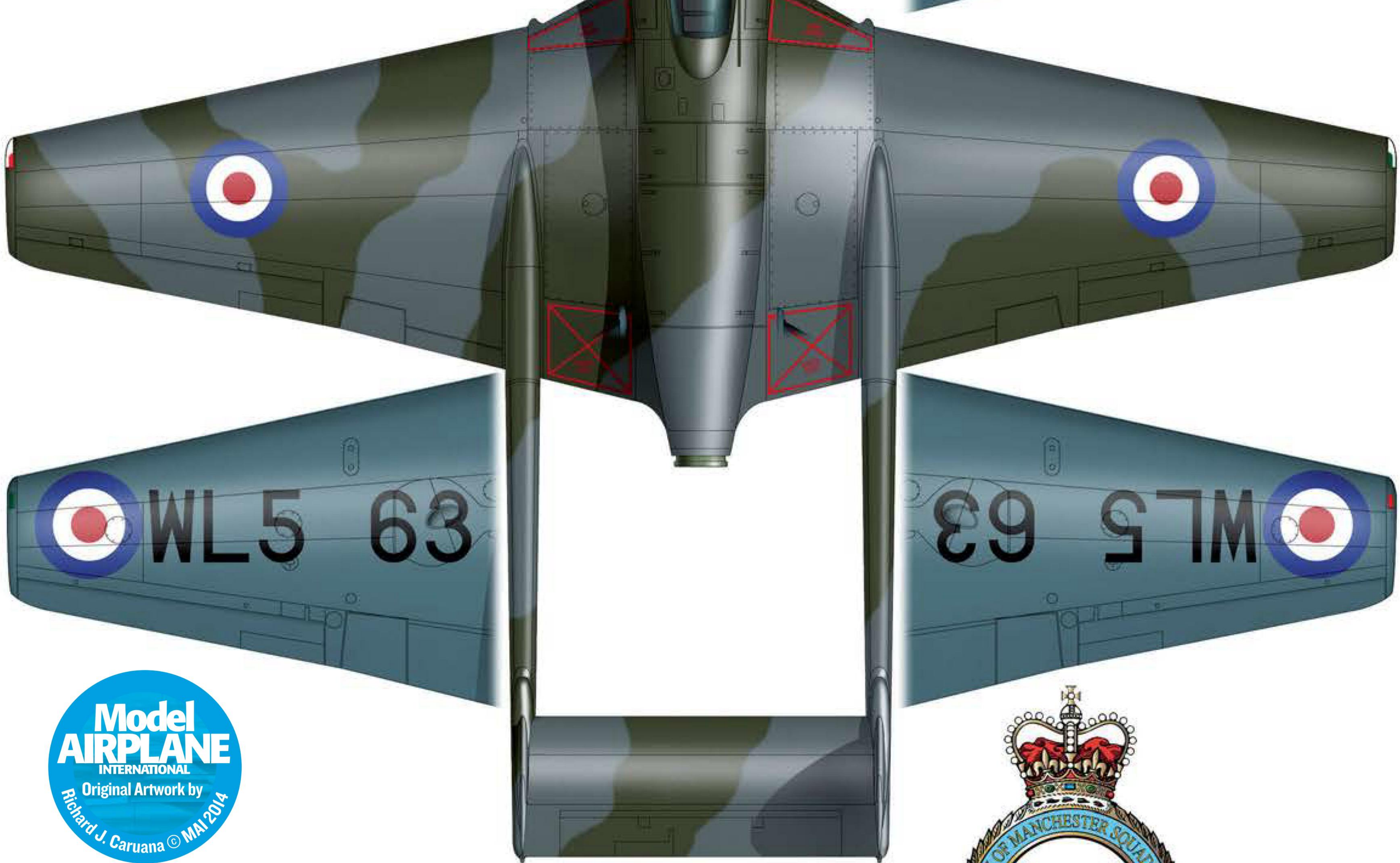
De Havilland Vampire FB Mk 9, NZ5753, No.75 Squadron, Royal New Zealand Air Force, 1953. Dark Sea Grey/Dark Green upper surfaces with Aluminium undersides; roundels in six positions. Serial in black, repeated below wings; red bars with yellow diamonds flanking tail boom roundels







De Havilland Vampire FB Mk 9, WR264/29, RAF Flying College, Cranwell, 1960. Dark Sea Grey/Dark Green upper surfaces with PRU Blue undersides. Dayglo trim to tailbooms and nose. Roundel on booms placed over a light blue band, outlined in dark blue. Black serial, white code on nose, the latter repeated on a Dayglo nosewheel door



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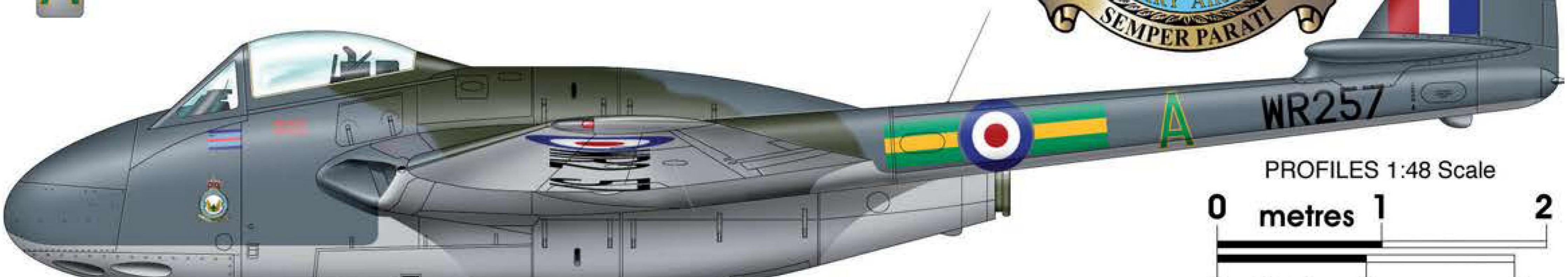
De Havilland Vampire FB Mk 9, WR257/A, No.613 'City of Manchester' Squadron, RAuxAF, Ringway, 1956. Dark Sea Grey/Dark Green upper surfaces with Aluminium undersides. Black serial, green code 'A' outlined in yellow, the latter repeated on nose wheel door. Green/Yellow bars flanking tailboom roundels. Rank pennant below windscreen; unit crest on nose



MiG-15
ProfiPACK 1/72
Cat. No. 7057
RECOMMENDED:
672020
672008
672022
672021 MiG-15 airbrakes (Brassin)
672022 MiG-15 cockpit (Brassin)
672008 MiG-15 seat (Brassin)
672007 MiG-15 wheels (Brassin)
72575 MiG-15/ MiG-15bis exterior (PE-SET)
72574 MiG-15 landing flaps (PE-SET)
72
5 markings
Cartograf decals
Color photo-etched sets
and painting mask.
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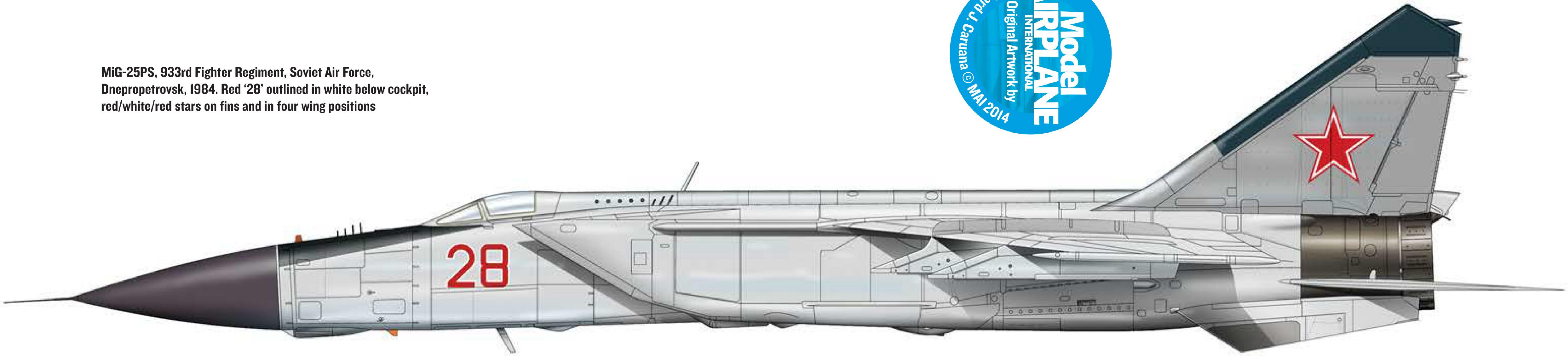
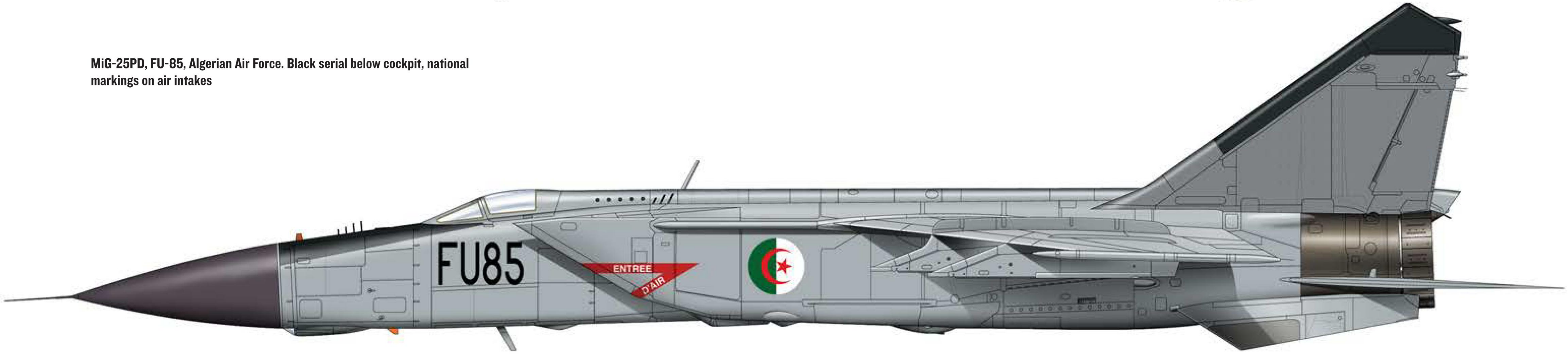
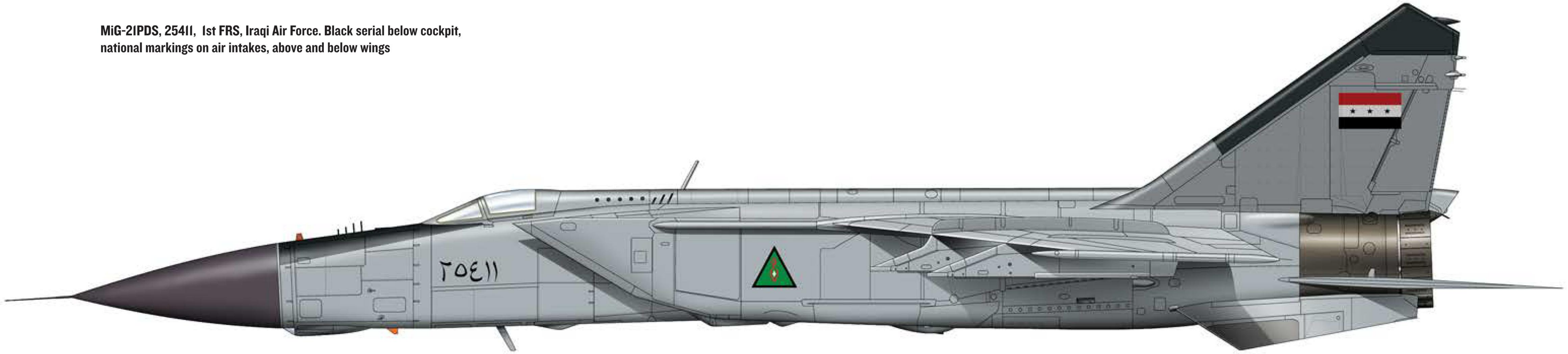
MiG-25PS, 933rd Fighter Regiment, Soviet Air Force, Dnepropetrovsk, 1984. Red '28' outlined in white below cockpit, red/white/red stars on fins and in four wing positions



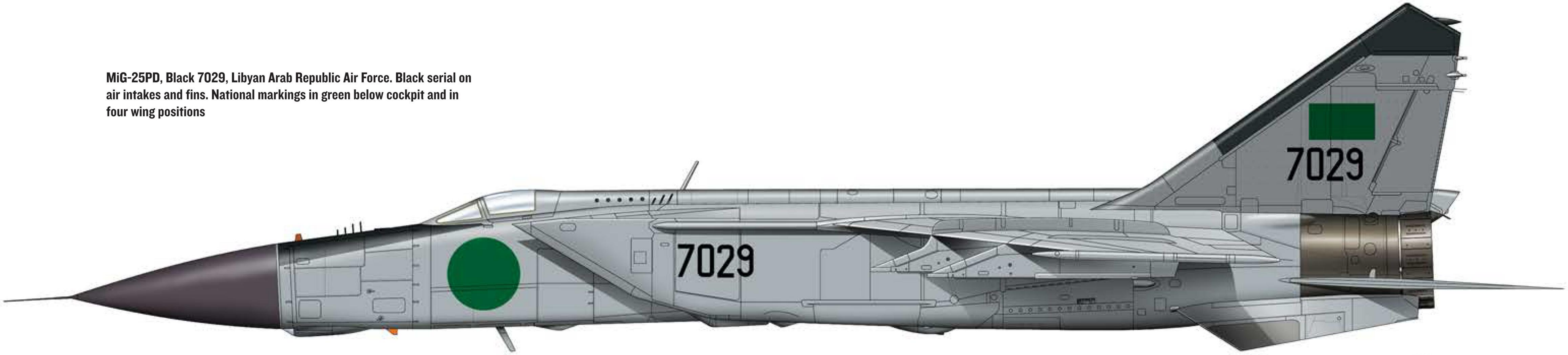
MiG-25PD, FU-85, Algerian Air Force. Black serial below cockpit, national markings on air intakes



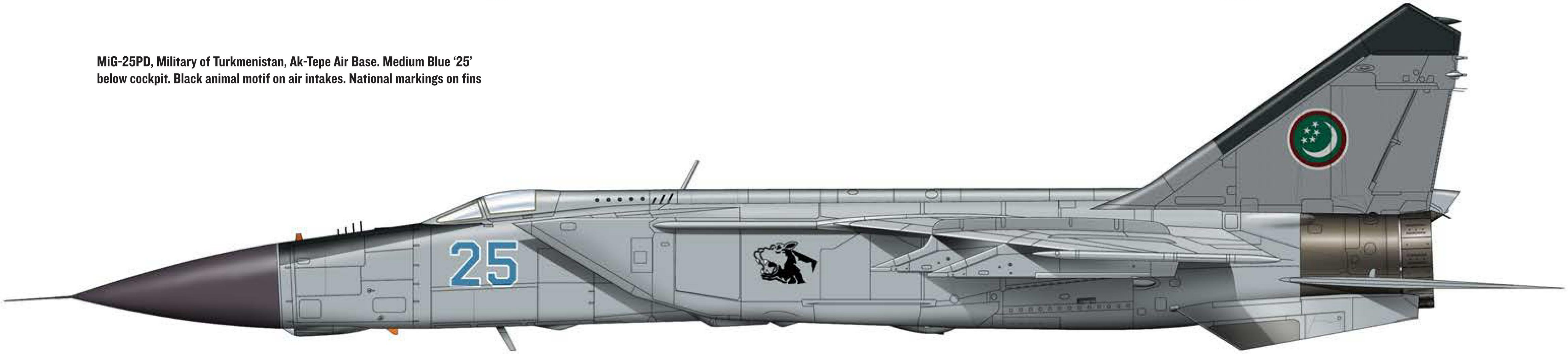
MiG-21PDS, 25411, 1st FRS, Iraqi Air Force. Black serial below cockpit, national markings on air intakes, above and below wings



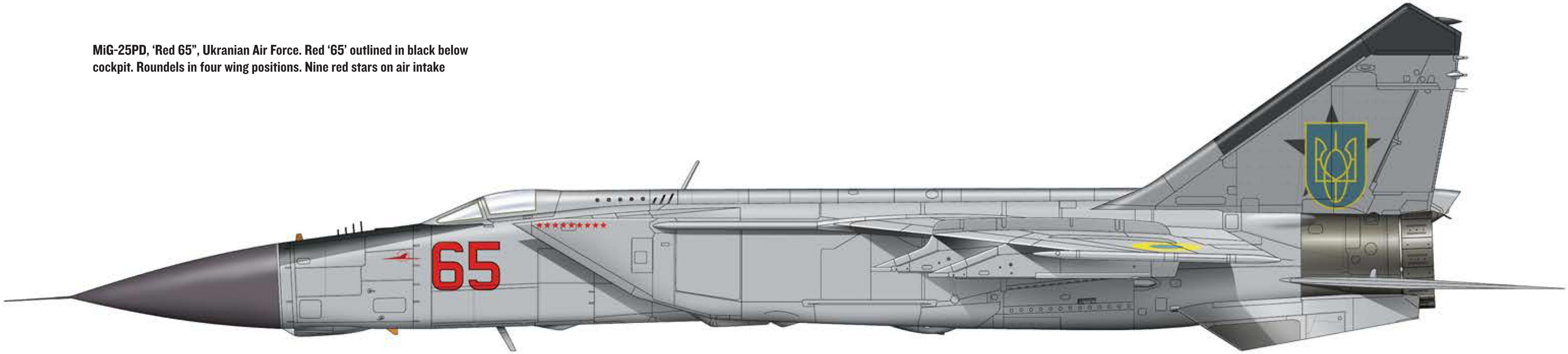
MiG-25PD, Black 7029, Libyan Arab Republic Air Force. Black serial on air intakes and fins. National markings in green below cockpit and in four wing positions



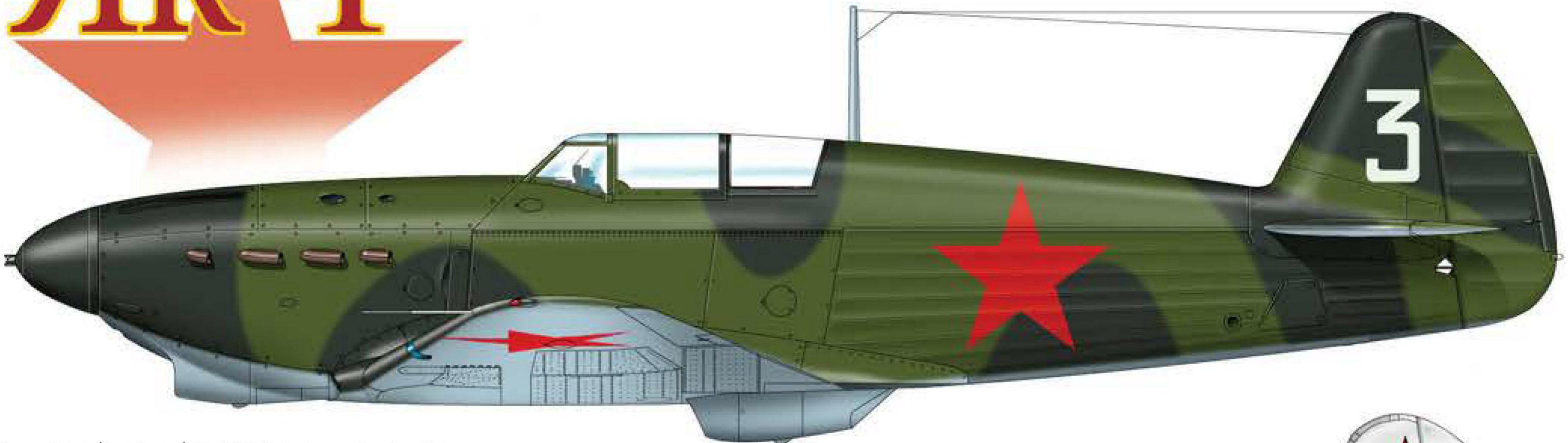
MiG-25PD, Military of Turkmenistan, Ak-Tepe Air Base. Medium Blue '25' below cockpit. Black animal motif on air intakes. National markings on fins



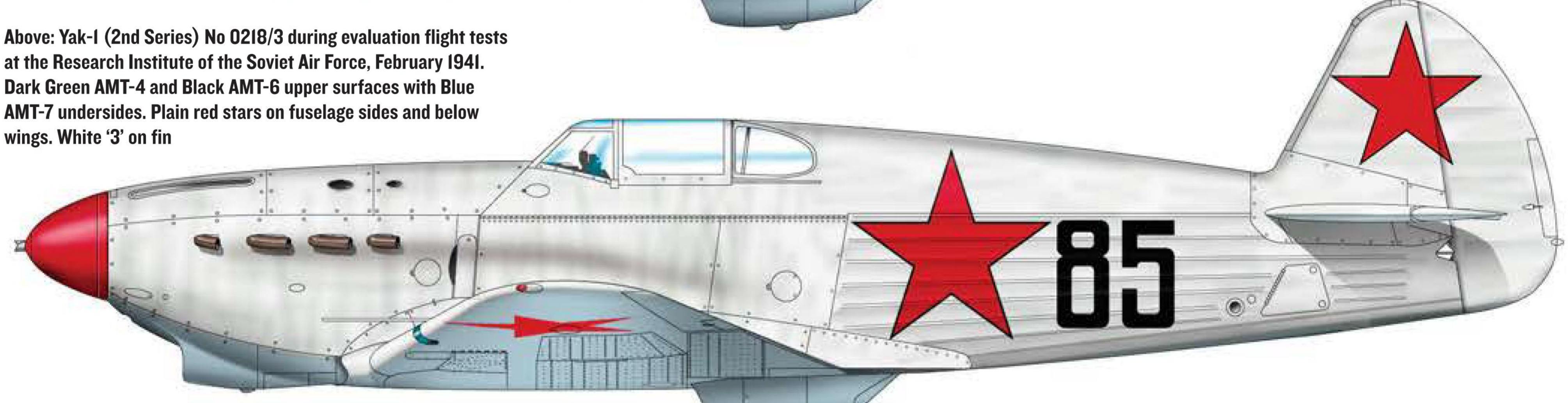
MiG-25PD, 'Red 65", Ukranian Air Force. Red '65' outlined in black below cockpit. Roundels in four wing positions. Nine red stars on air intake



Як-1 YAKOVLEV YAK-1

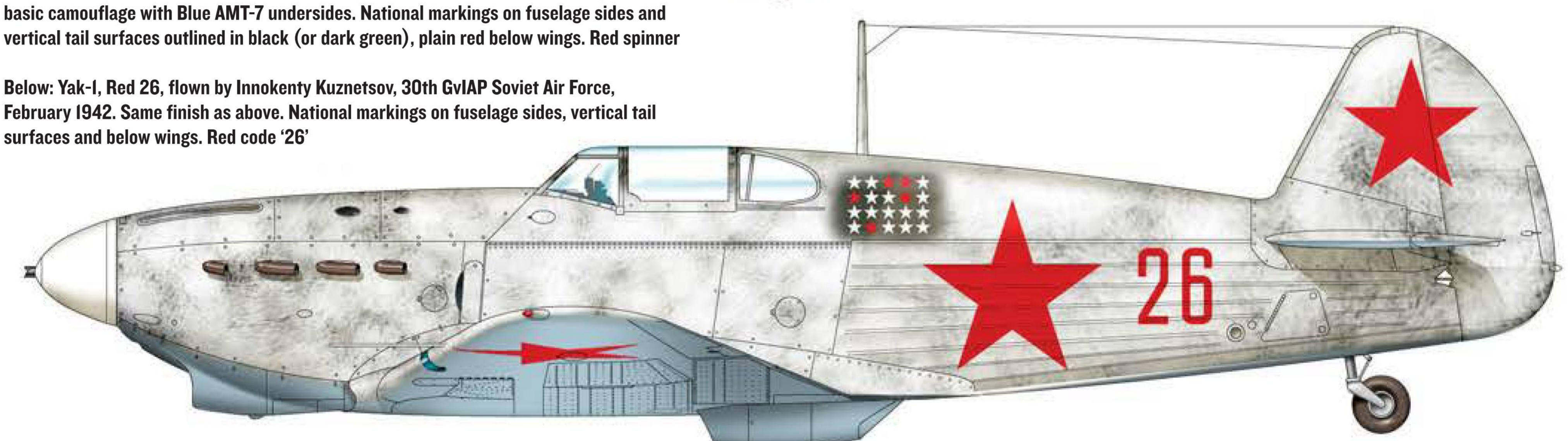


Above: Yak-1 (2nd Series) No 0218/3 during evaluation flight tests at the Research Institute of the Soviet Air Force, February 1941. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blue AMT-7 undersides. Plain red stars on fuselage sides and below wings. White '3' on fin

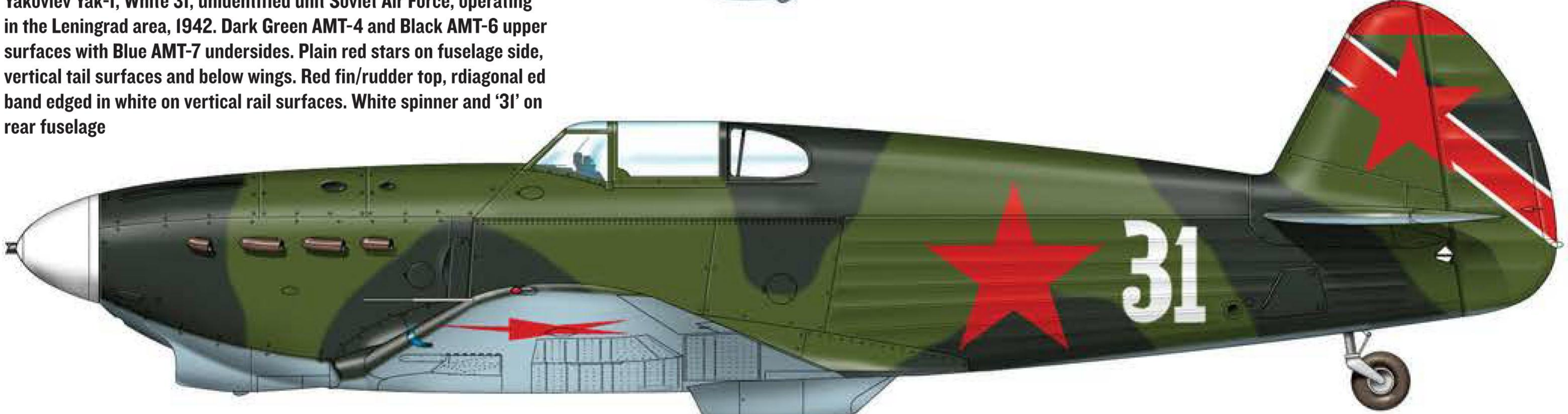


Yakovlev Yak-1, Black 85, Soviet Air Force, Winter 1941. Washable white distemper over its basic camouflage with Blue AMT-7 undersides. National markings on fuselage sides and vertical tail surfaces outlined in black (or dark green), plain red below wings. Red spinner

Below: Yak-1, Red 26, flown by Innokenty Kuznetsov, 30th GvIAP Soviet Air Force, February 1942. Same finish as above. National markings on fuselage sides, vertical tail surfaces and below wings. Red code '26'

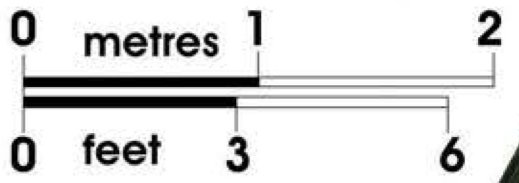


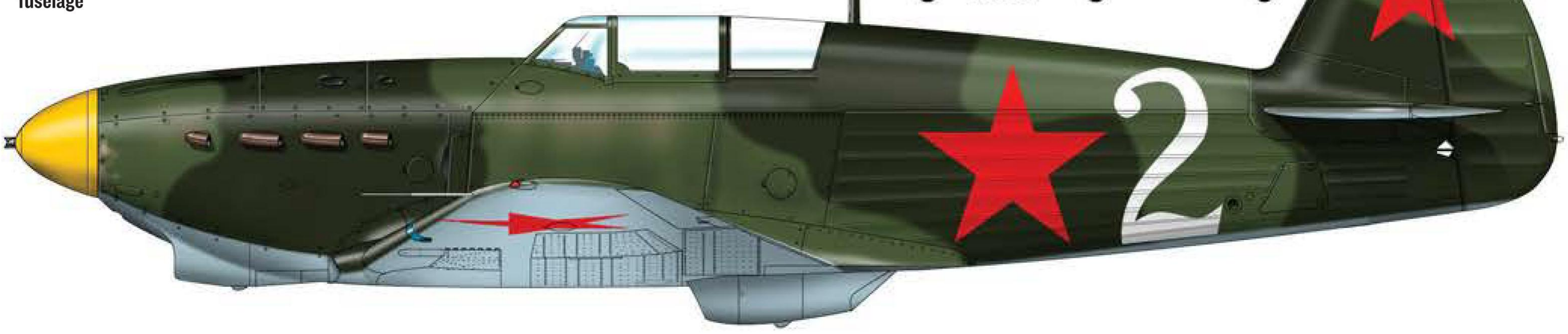
Yakovlev Yak-1, White 31, unidentified unit Soviet Air Force, operating in the Leningrad area, 1942. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blue AMT-7 undersides. Plain red stars on fuselage side, vertical tail surfaces and below wings. Red fin/rudder top, rdiagonal ed band edged in white on vertical rail surfaces. White spinner and '31' on rear fuselage



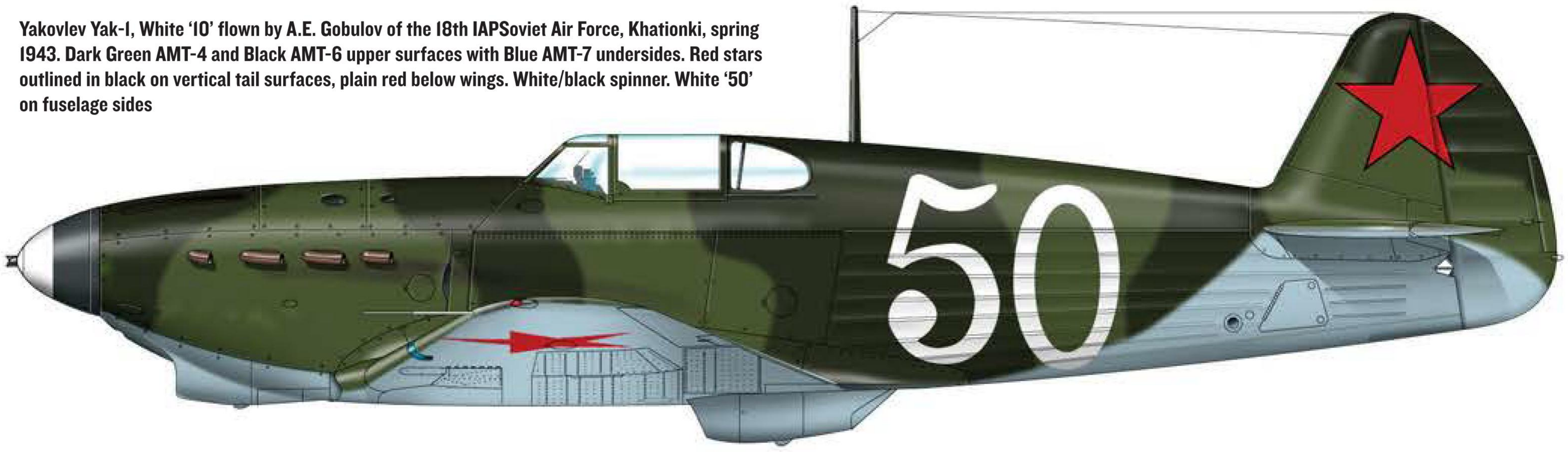
Yakovlev Yak-1 (variant) of an unidentified Soviet Air Force unit operating on the Leningrad Front , Spring 1942. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blue AMT-7 undersides. National markings on fuselage sides, vertical tail surfaces and below wings. Yellow spinner, white code '2' on rear fuselage

PROFILES 1:48 Scale

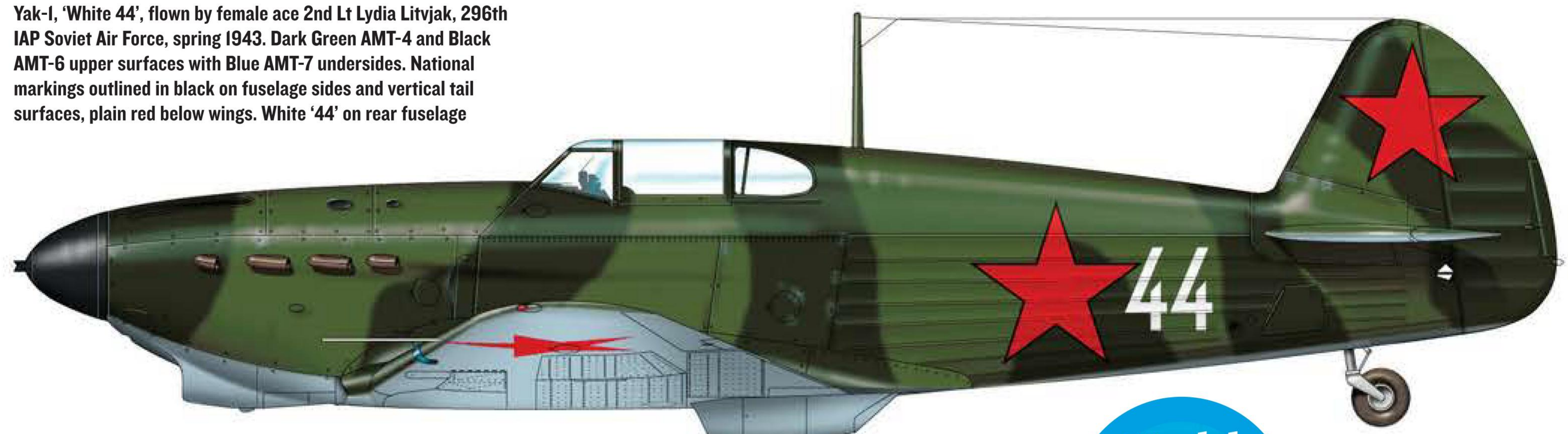




Yakovlev Yak-1, White '10' flown by A.E. Gobulov of the 18th IAPSoviet Air Force, Khationki, spring 1943. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blue AMT-7 undersides. Red stars outlined in black on vertical tail surfaces, plain red below wings. White/black spinner. White '50' on fuselage sides



Yak-1, 'White 44', flown by female ace 2nd Lt Lydia Litvjak, 296th IAP Soviet Air Force, spring 1943. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blue AMT-7 undersides. National markings outlined in black on fuselage sides and vertical tail surfaces, plain red below wings. White '44' on rear fuselage



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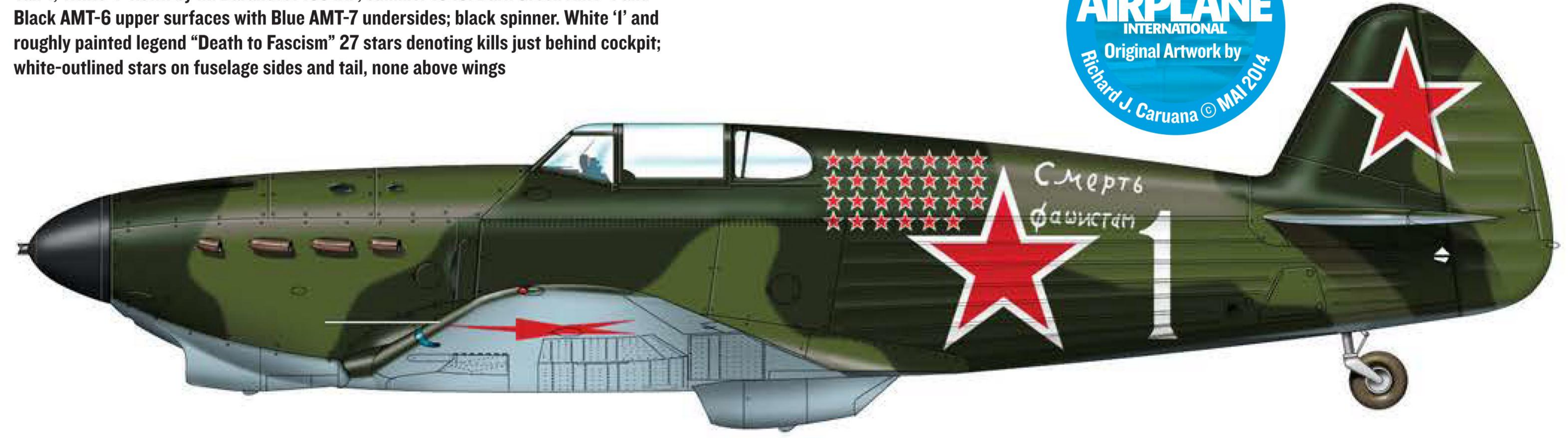
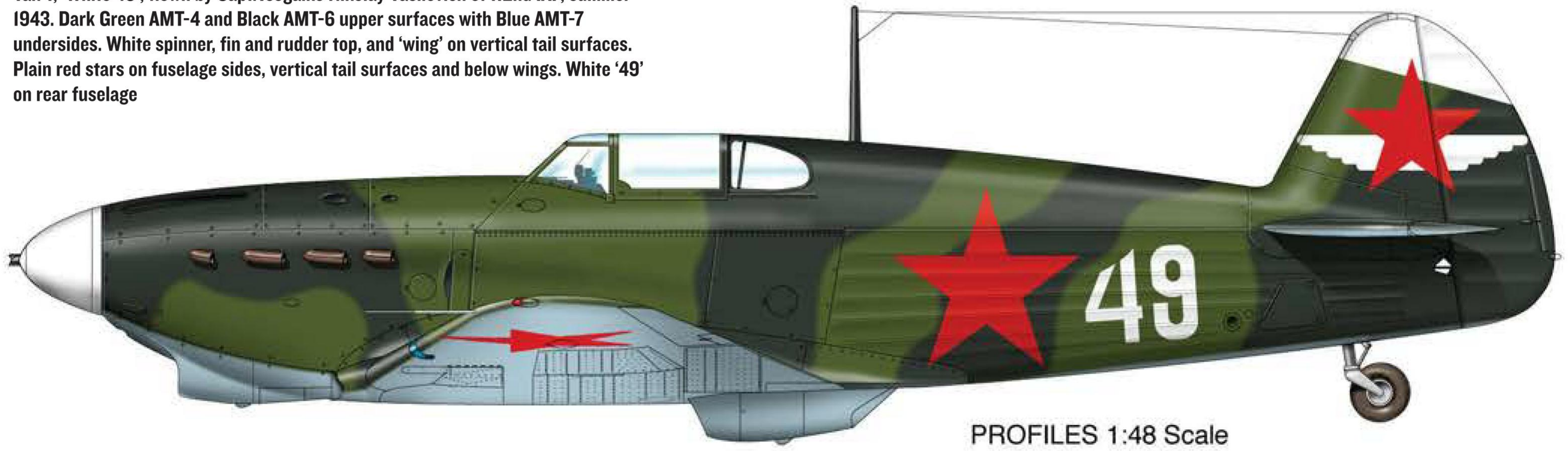
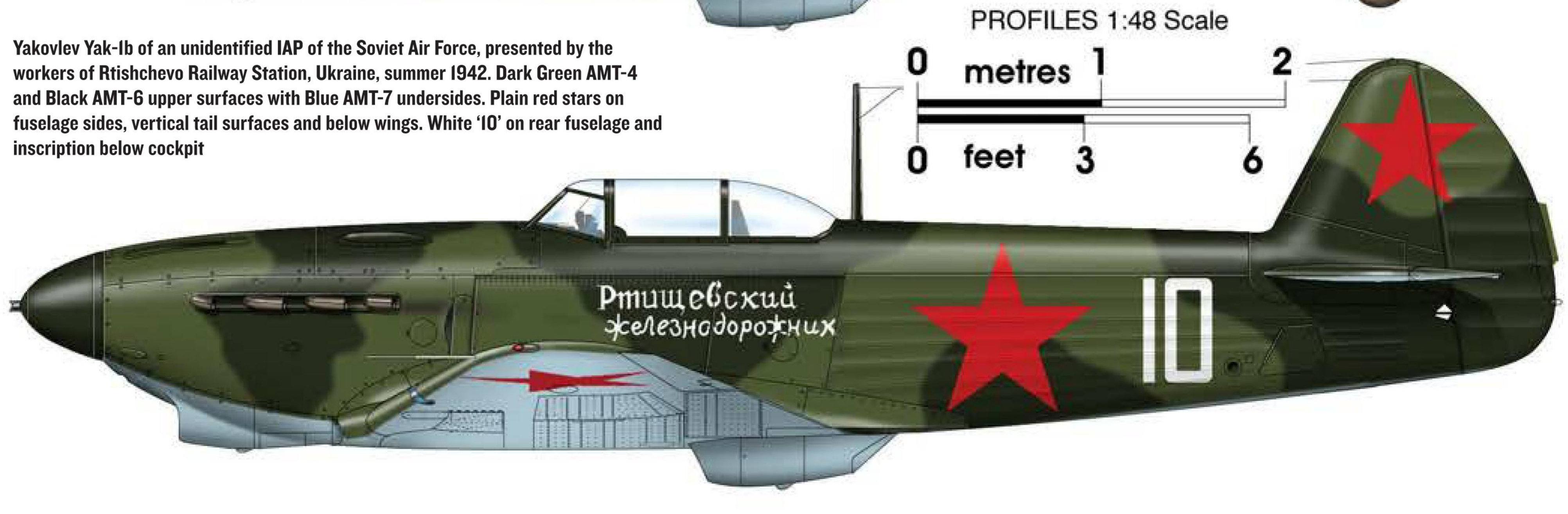
Yak-1, White '1' flown by M. Baranovof 183 IAP, summer 1943. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blue AMT-7 undersides; black spinner. White '1' and roughly painted legend "Death to Fascism" 27 stars denoting kills just behind cockpit; white-outlined stars on fuselage sides and tail, none above wings

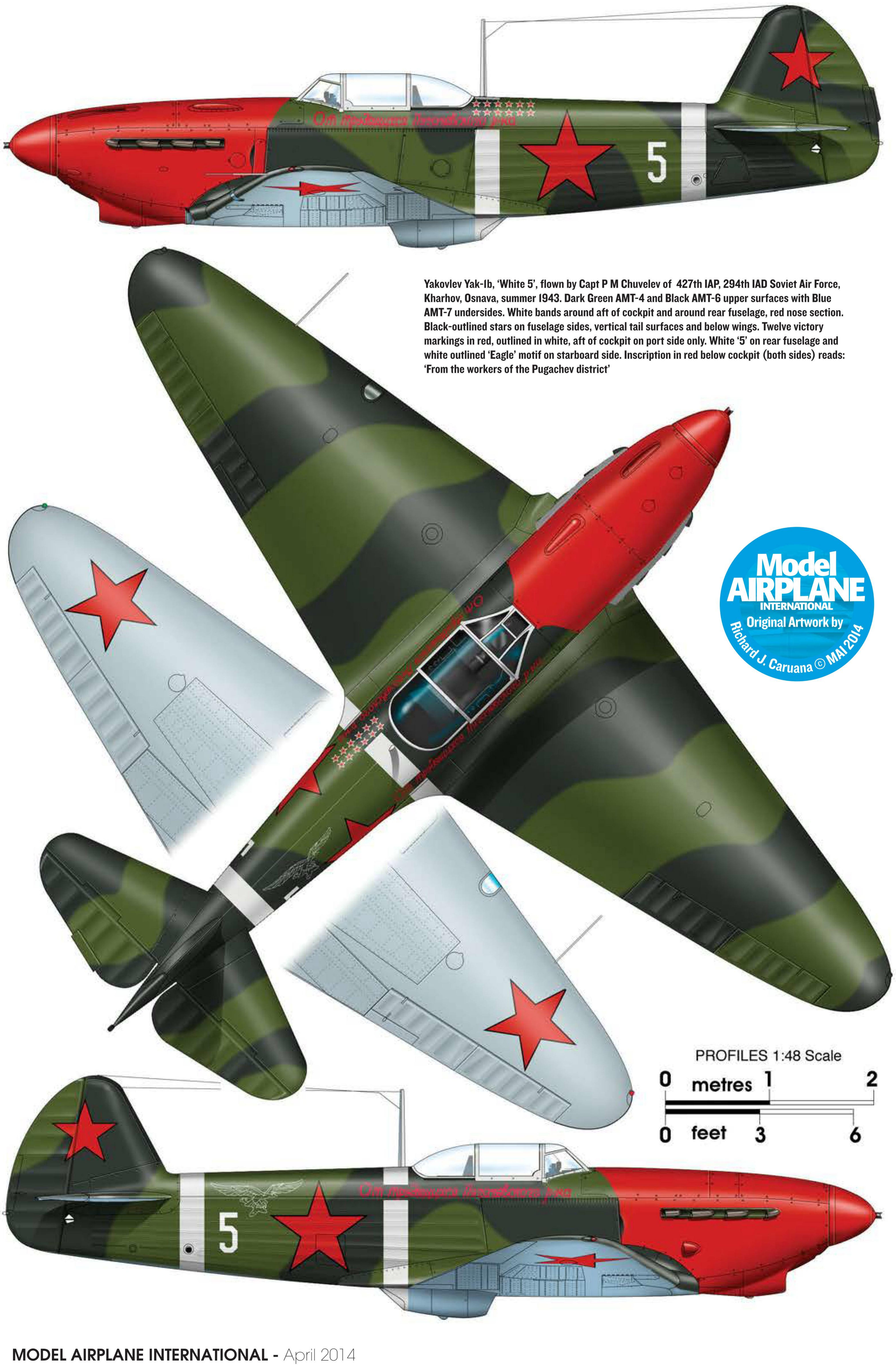


Yak-1, 'White 49', flown by Capt.Tsogaiko Nikolay Vasilevich of 112nd IAP, summer 1943. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blue AMT-7 undersides. White spinner, fin and rudder top, and 'wing' on vertical tail surfaces. Plain red stars on fuselage sides, vertical tail surfaces and below wings. White '49' on rear fuselage



Yakovlev Yak-1b of an unidentified IAP of the Soviet Air Force, presented by the workers of Rtishchevo Railway Station, Ukraine, summer 1942. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blue AMT-7 undersides. Plain red stars on fuselage sides, vertical tail surfaces and below wings. White '10' on rear fuselage and inscription below cockpit

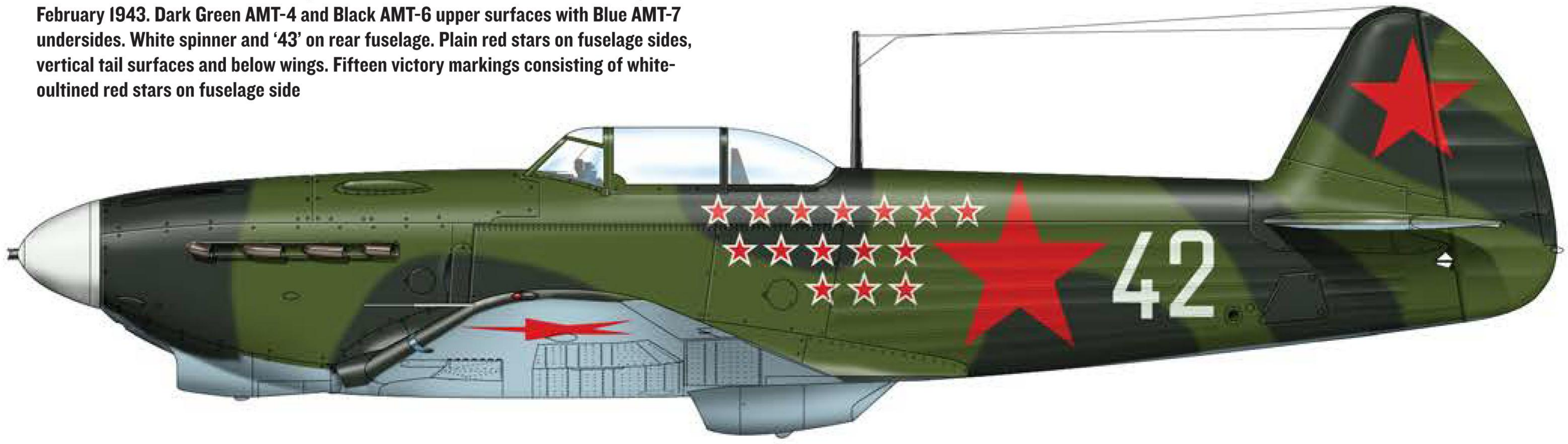




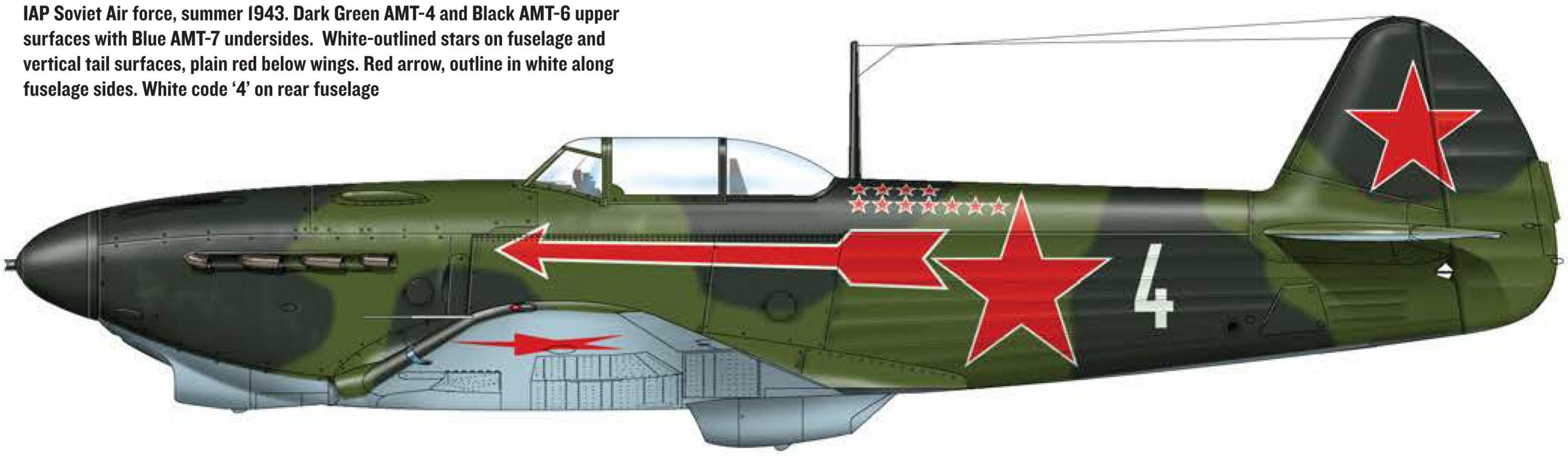
Yakovlev Yak-1b, 'White 5', flown by Capt P M Chuvelev of 427th IAP, 294th IAD Soviet Air Force, Kharhov, Osnava, summer 1943. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blue AMT-7 undersides. White bands around aft of cockpit and around rear fuselage, red nose section. Black-outlined stars on fuselage sides, vertical tail surfaces and below wings. Twelve victory markings in red, outlined in white, aft of cockpit on port side only. White '5' on rear fuselage and white outlined 'Eagle' motif on starboard side. Inscription in red below cockpit (both sides) reads: 'From the workers of the Pugachev district'

Yakovlev Yak-1b flown by Major B.N. Jeremin, Soviet Air Force, winter 1942-43. Temporary white distemper over upper surface camouflage, with Blue AMT-7 undersides. Red stars on fuselage sides, vertical tail surfaces and below wings. The aircraft was the first donated to this pilot by a foundation headed by farmer F.P. Golovatov as indicated by the inscription in red; he was later donated a Yak-3 by the same foundation

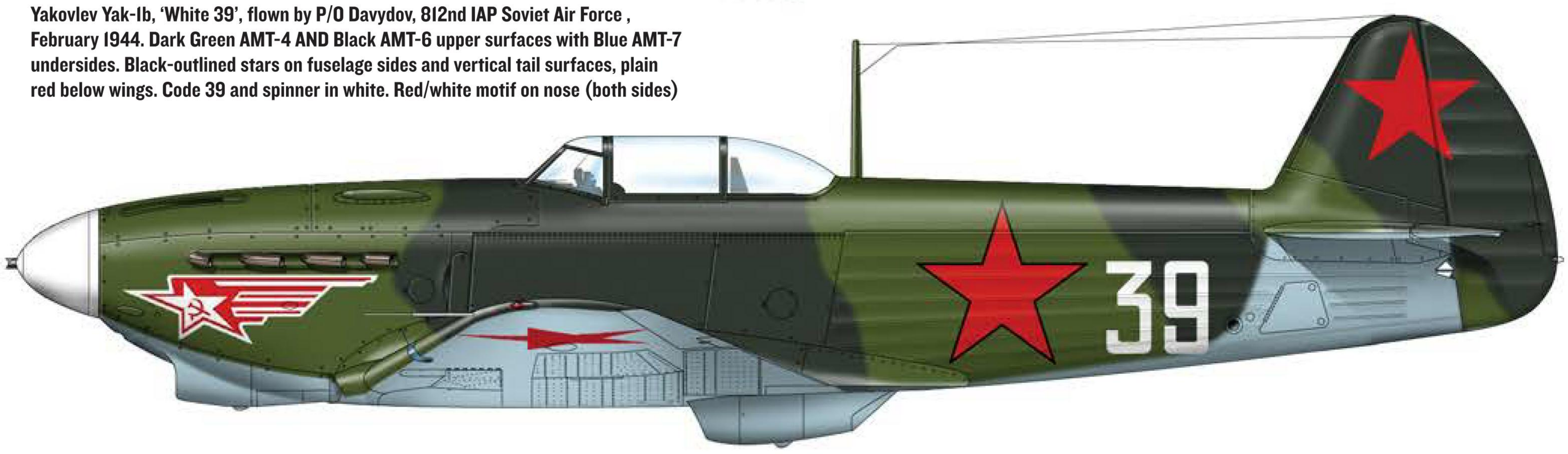
Yakovlev Yak-1b, 'White 42', flown by Kozlov fo 910 IAP Soviet Air Force, Borisoglebsk. February 1943. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blue AMT-7 undersides. White spinner and '43' on rear fuselage. Plain red stars on fuselage sides, vertical tail surfaces and below wings. Fifteen victory markings consisting of white-outlined red stars on fuselage side



Yakovlev Yak-1b, 'White 4', flown by Capt. Lugansky Sergey Danilovich, 270th IAP Soviet Air force, summer 1943. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blue AMT-7 undersides. White-outlined stars on fuselage and vertical tail surfaces, plain red below wings. Red arrow, outline in white along fuselage sides. White code '4' on rear fuselage

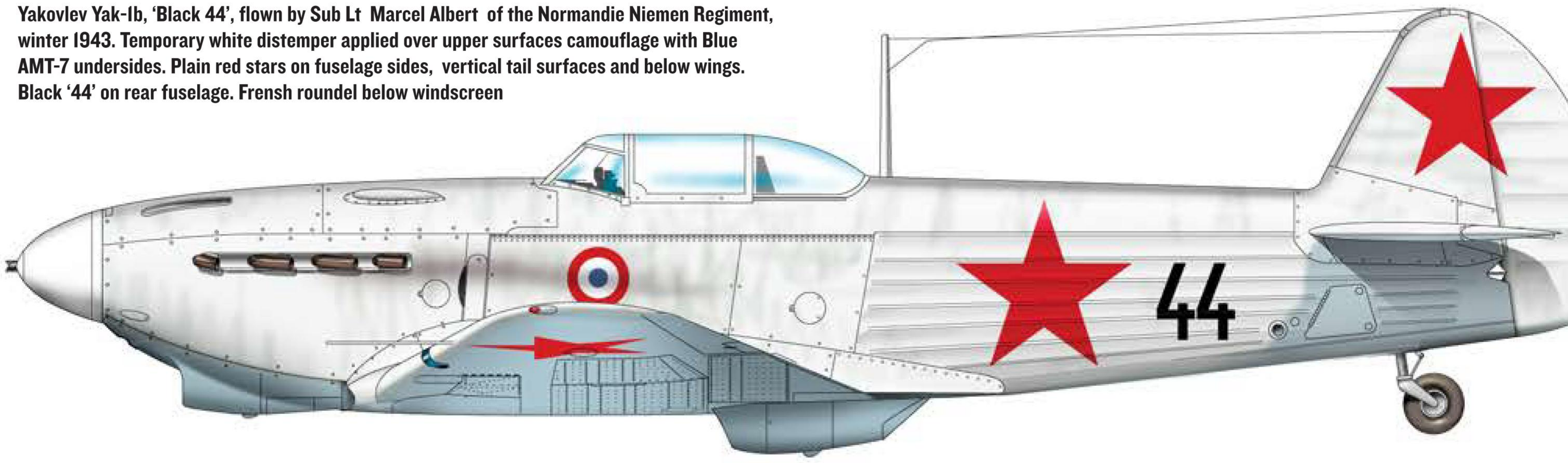


Yakovlev Yak-1b, 'White 39', flown by P/O Davydov, 812nd IAP Soviet Air Force, February 1944. Dark Green AMT-4 AND Black AMT-6 upper surfaces with Blue AMT-7 undersides. Black-outlined stars on fuselage sides and vertical tail surfaces, plain red below wings. Code 39 and spinner in white. Red/white motif on nose (both sides)

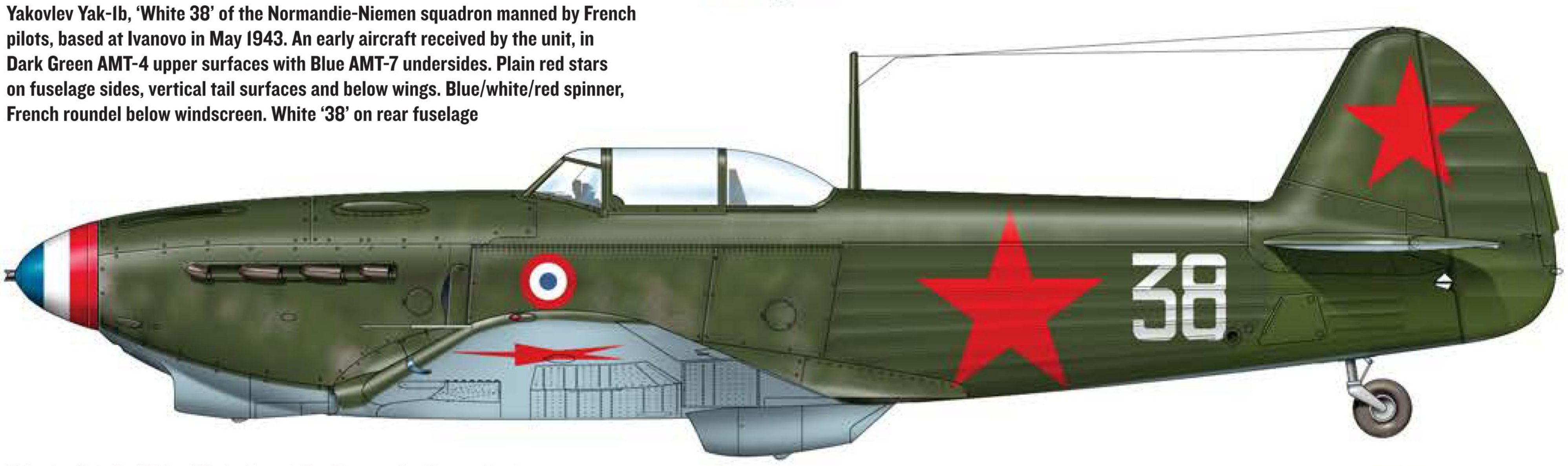


Yakovlev Yak-1b, 31 GvIAP Soviet Air Force, 1944. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blue AMT-7 undersides. White-outlined stars on fuselage sides and vertical tail surfaces, plain red below wings. Two red diagonal ands on fin. Inscription below cockpit in white

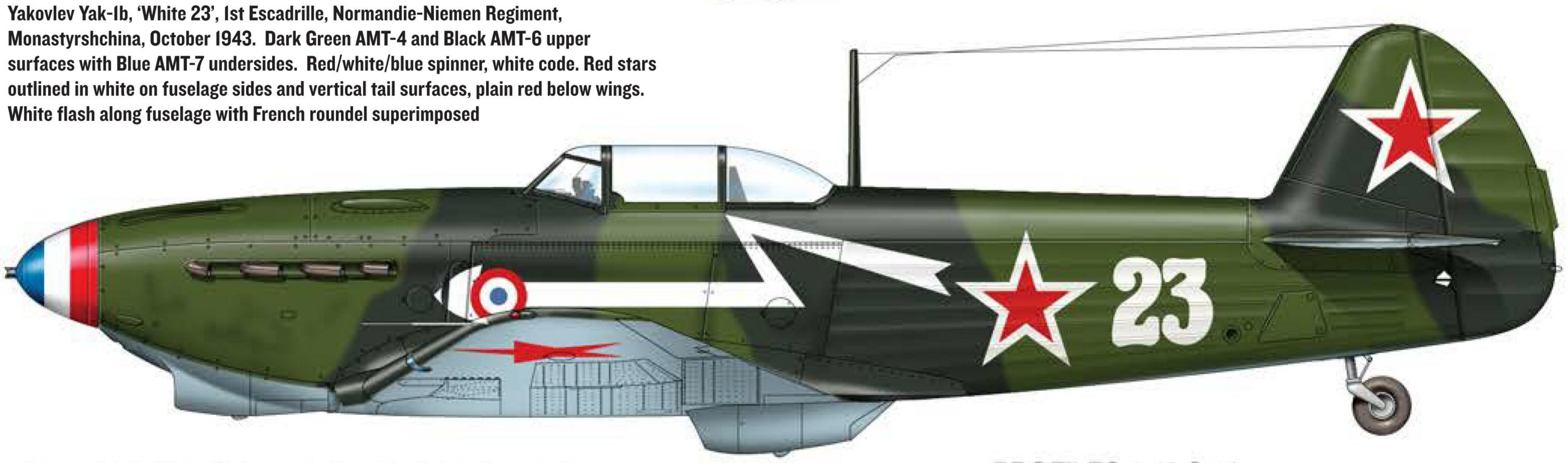
Yakovlev Yak-Ib, 'Black 44', flown by Sub Lt Marcel Albert of the Normandie Niemen Regiment, winter I943. Temporary white distemper applied over upper surfaces camouflage with Blue AMT-7 undersides. Plain red stars on fuselage sides, vertical tail surfaces and below wings. Black '44' on rear fuselage. Frensh roundel below windscreen



Yakovlev Yak-Ib, 'White 38' of the Normandie-Niemen squadron manned by French pilots, based at Ivanovo in May I943. An early aircraft received by the unit, in Dark Green AMT-4 upper surfaces with Blue AMT-7 undersides. Plain red stars on fuselage sides, vertical tail surfaces and below wings. Blue/white/red spinner, French roundel below windscreen. White '38' on rear fuselage



Yakovlev Yak-Ib, 'White 23', Ist Escadrille, Normandie-Niemen Regiment, Monastyrshchina, October I943. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blue AMT-7 undersides. Red/white/blue spinner, white code. Red stars outlined in white on fuselage sides and vertical tail surfaces, plain red below wings. White flash along fuselage with French roundel superimposed



Yakovlev Yak-Ib, 'White 43', flown by Lt Albert Littolf of the Normadie-Niemen Regiment, Hatenki, June I943. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blue AMT-7 undersides. Blue/white/red spinner, white code '43' on rear fuselage. French roundel below windscreen. Plain red stars on fuselage sides, vertical tail surfaces and below wings. Victory tally of eleven black swastikas on white disks below cockpit, with an additional plain white disk at the end

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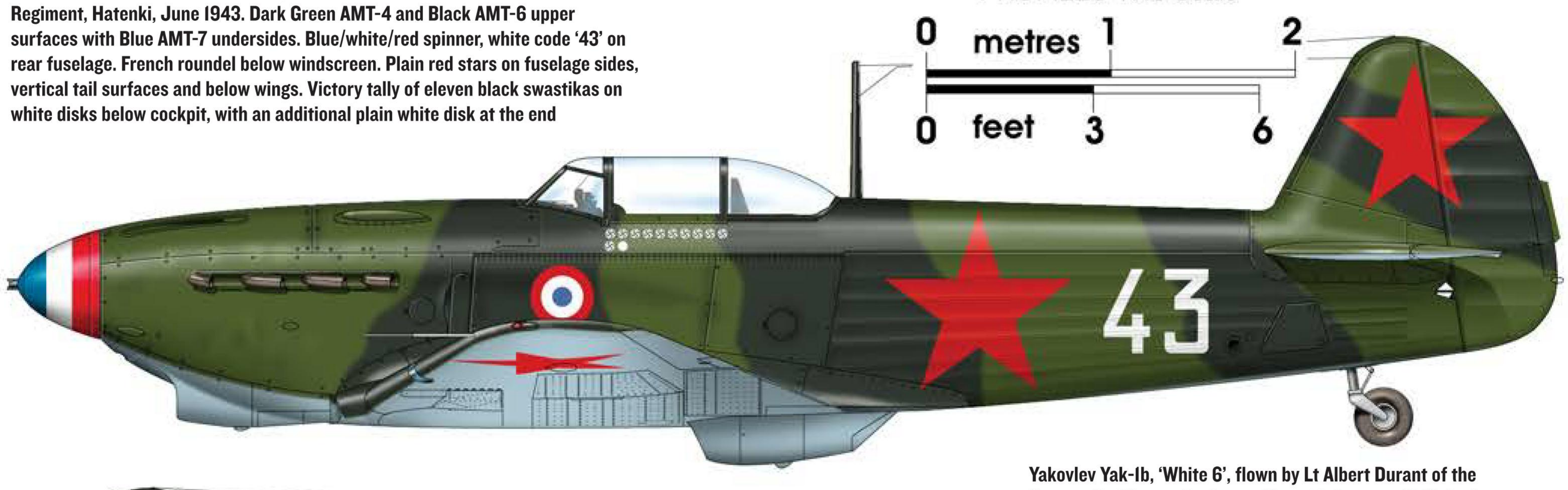

Yakovlev Yak-Ib, 'White 6', flown by Lt Albert Durant of the Normandie-Niemen Regiment, Hatenki. Summer I943. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blue AMT-7 undersides. Plain red stars on fuselage sides, vertical tail surfaces and below wings. Black/white/red 'sharkmouth' motif, with 'fish-scale' effect painted onto the nose area. White spinner and code

Yak-1, captured by the Germans. Dark Green AMT-4 and Black AMT-6 upper surfaces with Blues AMT-7 undersides. Soviet markings overpainted, probably in RLM 70. RLM 04 Gelb rear fuselage band; standard Luftwaffe markings. Black spinner

Below: Yakovlev Yak-1b of No 1 Polish Fighter Regiment "Warszawa" (1st Fighter Squadron), Eastern Front, late 1944. Grey AMT-11 and Dark Grey AMT -12 upper surfaces with Blue AMT-7 undersides. Red stars with white outlined on fuselage sides and vertical tail surfaces, plain red below wings. Yellow band around spinner, white code '12' on rear fuselage. Polish flag aft of engine cowling

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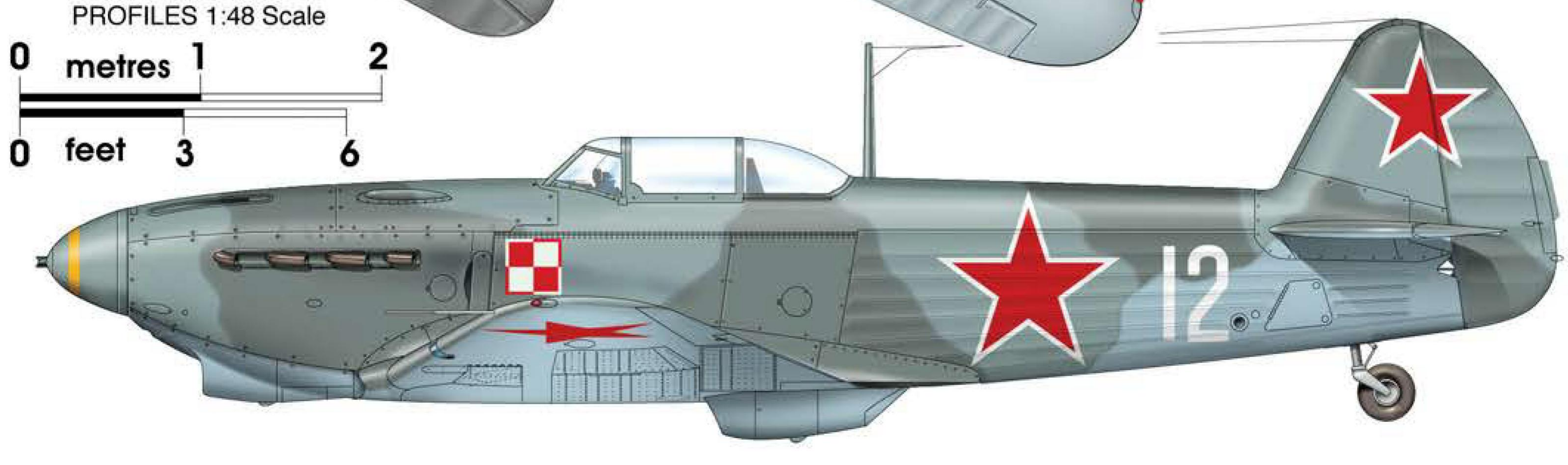

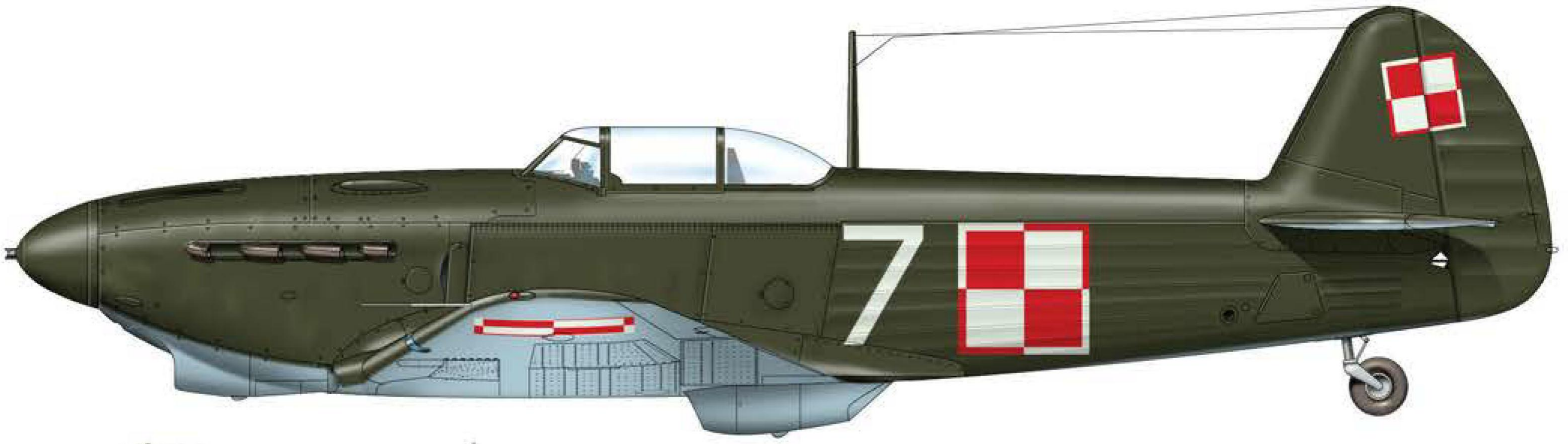

Above & Below Main View : Yakovlev Yak-1b, White '7' Polish Air Force in post-war service. Dark Green upper surfaces with Light Blue-Grey undersides. White '7' on rear fuselage. National markings in all four wing positions, on fuselage sides and vertical tail surfaces

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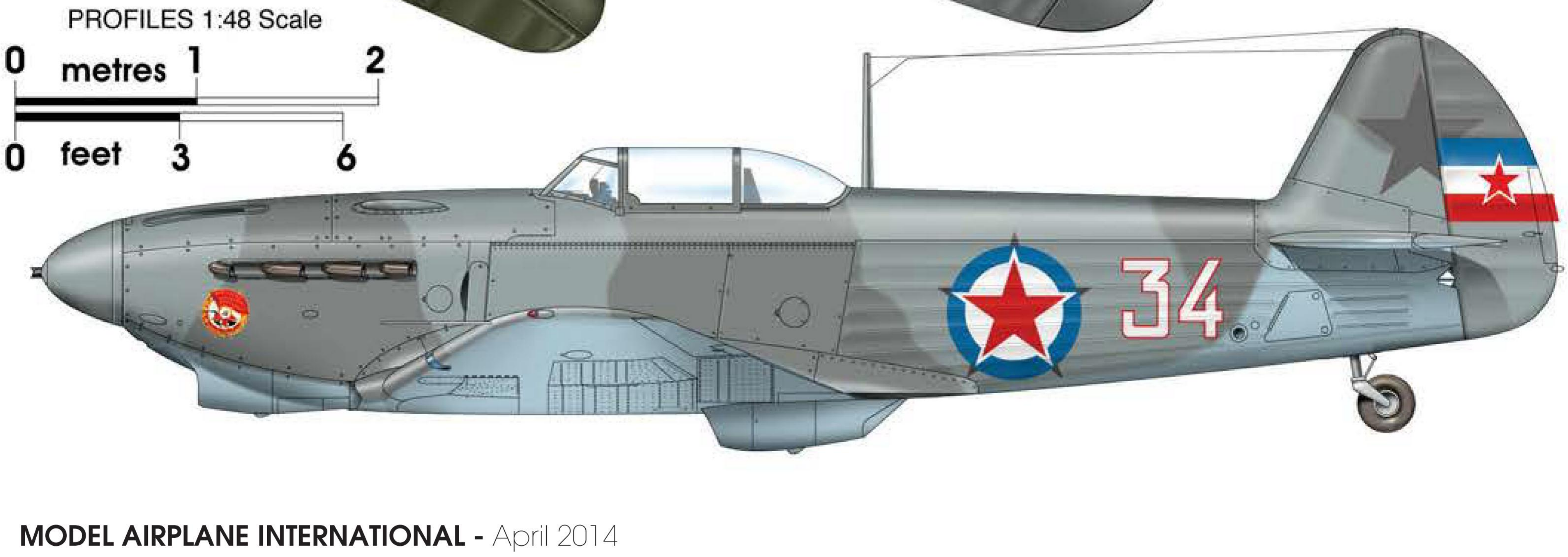
Below & Scrap Wing Views at Left: Yakovlev Yak-1b, '34', 112 Lovacki Puk, Yugoslav Air Force, Pleso. Summer 1945. Grey AMT-11 and Dark Grey AMT-12 upper surfaces with Blue AMT-7 undersides. White codes, outlined in red. National markings on fuselage sides and above wings. Guards' emblem on engine cowling



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Above: Avro Lancaster B Mk II, DS604, QR•W, No.61 Squadron, RAF Syerston, January 1943. It appears to wear a non-standard upper Dark Earth and Dark Green pattern in parts, probably due to local retouching. Note no spinners, and shallow bomb-aimers perspex nose fairing

Below: Avro Lancaster B Mk II, DS620, KO•W, No.115 Squadron RAF, East Wretham, March 1943. Dark Earth/Dark Green upper surfaces, Night undersides. C1 roundels on fuselage, B roundels above wings (no markings under wings). Serial and codes in Dull Red, mission markings in white

Avro Lancaster B Mk II, DS626, KO•J, No.115 Squadron. East Wretham, March 1943. Dark Earth/Dark Green upper surfaces with Night undersides; Dull Red codes and serials. Note shallow-type bomb-aimers perspex fairing and personal marking (designed by the mid-upper turret gunner, FS W.B. Baker) ahead of cockpit

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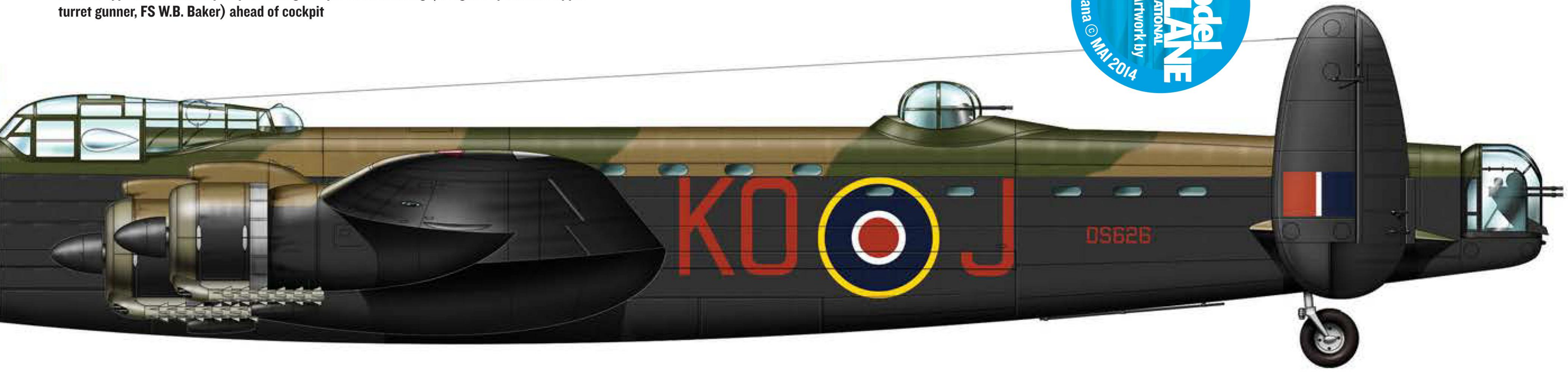
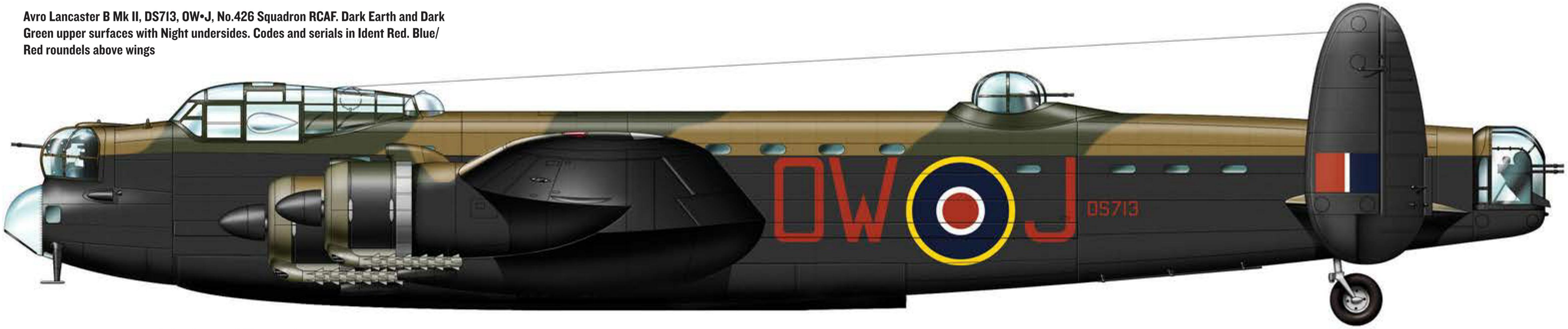
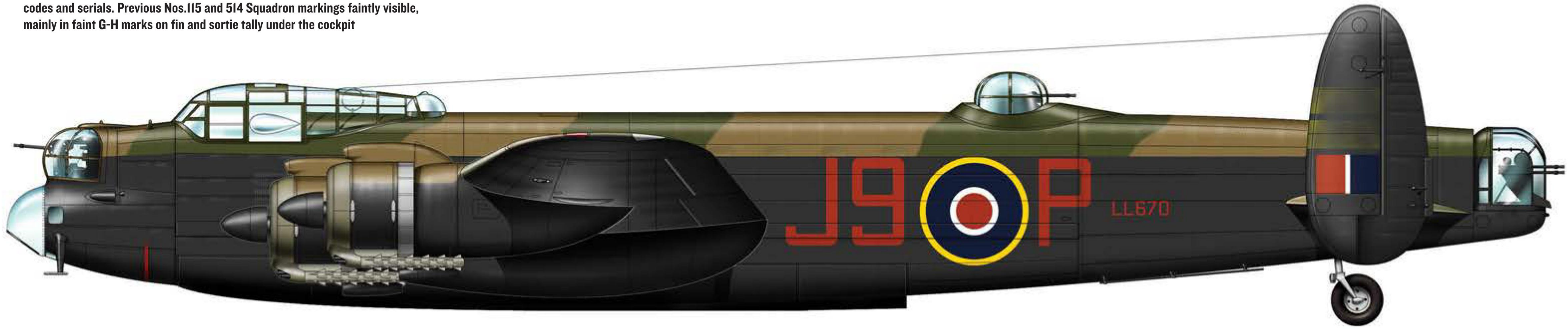


Avro Lancaster B Mk II, DS713, OW•J, No.426 Squadron RCAF. Dark Earth and Dark Green upper surfaces with Night undersides. Codes and serials in Ident Red. Blue/Red roundels above wings



Avro Lancaster B Mk II, LL670, J9•P, No.1666 Heavy Conversion Unit, Bottesford, early 1945. Dark Earth/Dark Green upper surfaces with Night undersides; Dull Red codes and serials. Previous Nos.115 and 514 Squadron markings faintly visible, mainly in faint G-H marks on fin and sortie tally under the cockpit



Avro Lancaster B Mk II, LL725, EQ•Z, No.408 Squadron, RCAF. Dark Earth and Dark Green upper surfaces with Night undersides. Codes and serial in Ident Red. 'Z' repeated in yellow on nose. 'Zombie' nose art on port side only

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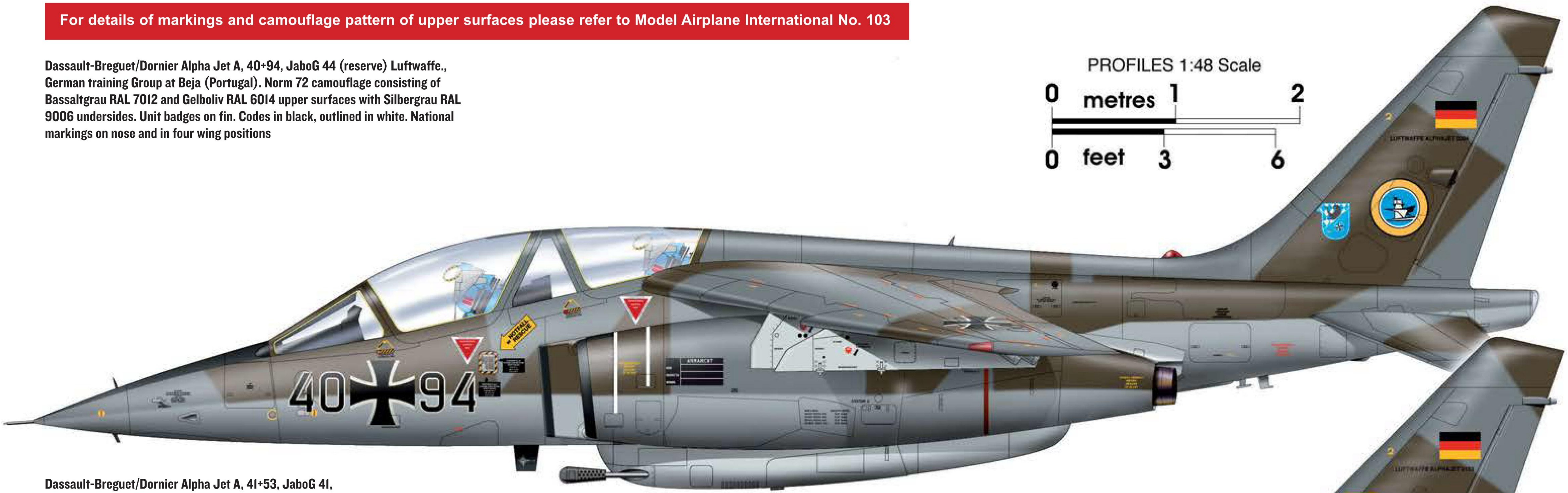
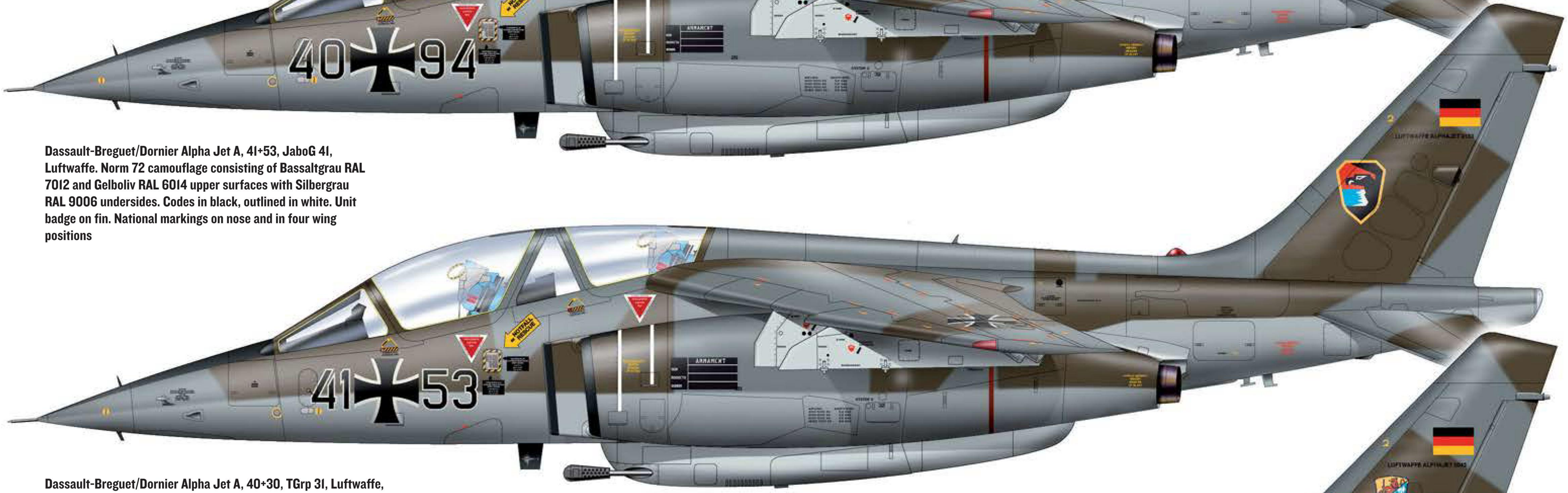
Dassault-Breguet/Dornier Alpha Jet A, 40+94, JaboG 44 (reserve) Luftwaffe., German training Group at Beja (Portugal). Norm 72 camouflage consisting of Bassaltgrau RAL 7012 and Gelboliv RAL 6014 upper surfaces with Silbergrau RAL 9006 undersides. Unit badges on fin. Codes in black, outlined in white. National markings on nose and in four wing positions



Dassault-Breguet/Dornier Alpha Jet A, 41+53, JaboG 41, Luftwaffe. Norm 72 camouflage consisting of Bassaltgrau RAL 7012 and Gelboliv RAL 6014 upper surfaces with Silbergrau RAL 9006 undersides. Codes in black, outlined in white. Unit badge on fin. National markings on nose and in four wing positions



Dassault-Breguet/Dornier Alpha Jet A, 40+30, TGrp 31, Luftwaffe, Leipheim, 1997. Norm 72 camouflage consisting of Bassaltgrau RAL 7012 and Gelboliv RAL 6014 upper surfaces with Silbergrau RAL 9006 undersides. Codes in black, outlined in white. Unit badge on fin together with that of JaboG 49. National markings on nose and in four wing positions

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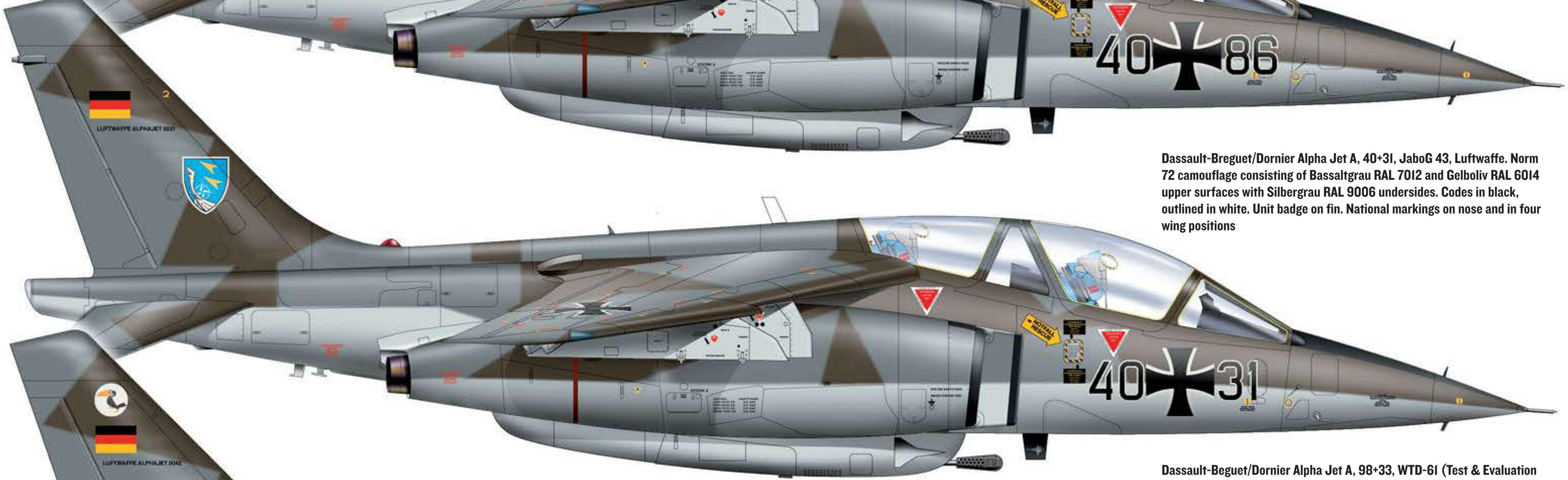
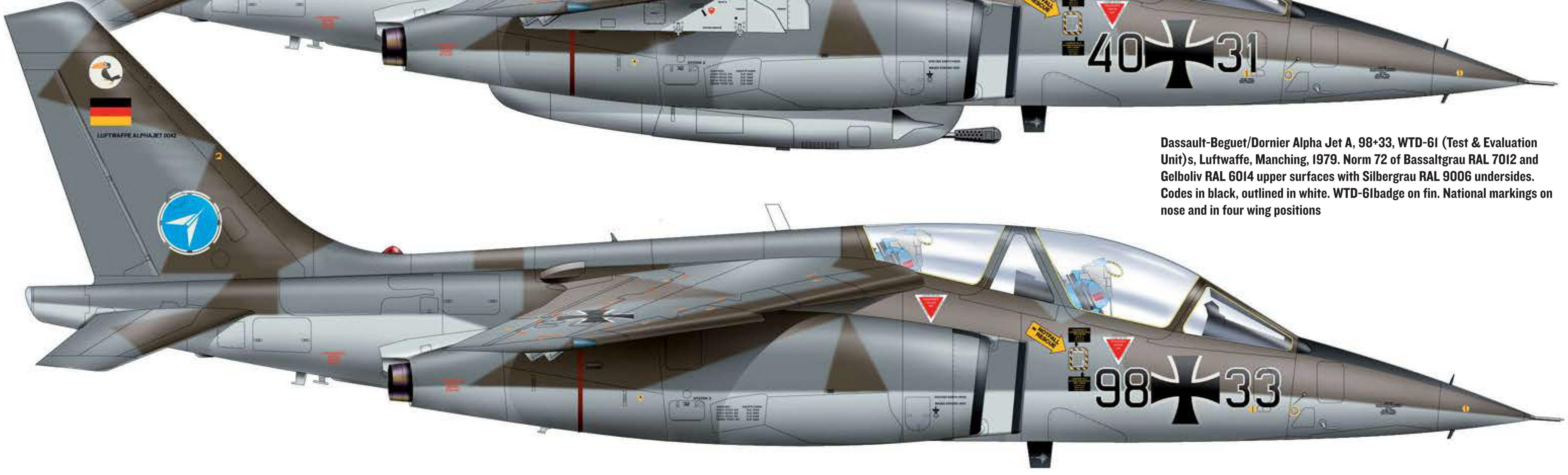
Dassault-Beguet/Dornier Alpha Jet A, 40+86, JaboG 43, Luftwaffe, 1983. Norm 72 camouflage consisting of Bassaltgrau RAL 7012 and Gelboliv RAL 6014 upper surfaces with Silbergrau RAL 9006 undersides. Codes in black, outlined in white. Unit badge on fin. Yellow fit top with black 'tiger' stripes. National markings on nose and in four wing positions



Dassault-Breguet/Dornier Alpha Jet A, 40+31, JaboG 43, Luftwaffe. Norm 72 camouflage consisting of Bassaltgrau RAL 7012 and Gelboliv RAL 6014 upper surfaces with Silbergrau RAL 9006 undersides. Codes in black, outlined in white. Unit badge on fin. National markings on nose and in four wing positions



Dassault-Beguet/Dornier Alpha Jet A, 98+33, WTD-61 (Test & Evaluation Unit)s, Luftwaffe, Manching, 1979. Norm 72 of Bassaltgrau RAL 7012 and Gelboliv RAL 6014 upper surfaces with Silbergrau RAL 9006 undersides. Codes in black, outlined in white. WTD-61badge on fin. National markings on nose and in four wing positions

Harvard Mk II, 2564, No.4 STFS Royal Canadian Air Force, Saskatoon (Saskatchewan), 1941. Dark Earth and Dark Green upper surfaces with Trainer Yellow undersides. Yellow panels above wings, horizontal tail surfaces and fuselage top aft of cockpit. All lettering in black. Blue/Red roundels above wings

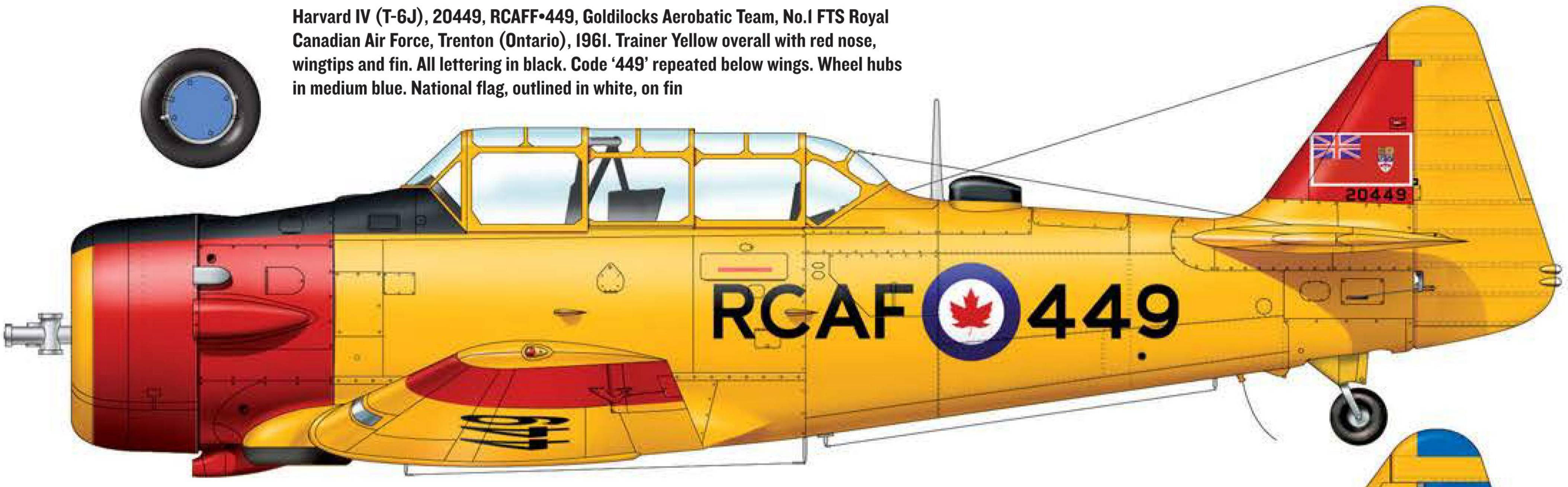
Harvard Mk II, 2588, 'Black 9', No.2 FTS, Royal Canadian Air Force, Uplands, 1941. Trainer Yellow overall with black anti-dazzle panel. All lettering in black with '2588' repeated below the wings. Roundels in six positions

Harvard Mk II, 2866, 'Black 43' No.2 FTS, Royal Canadian Air Force, Uplands, 1941. Trainer Yellow overall with black anti-dazzle panel. All lettering in black with '2588' repeated below port wing only. Blue/Red roundels above wings

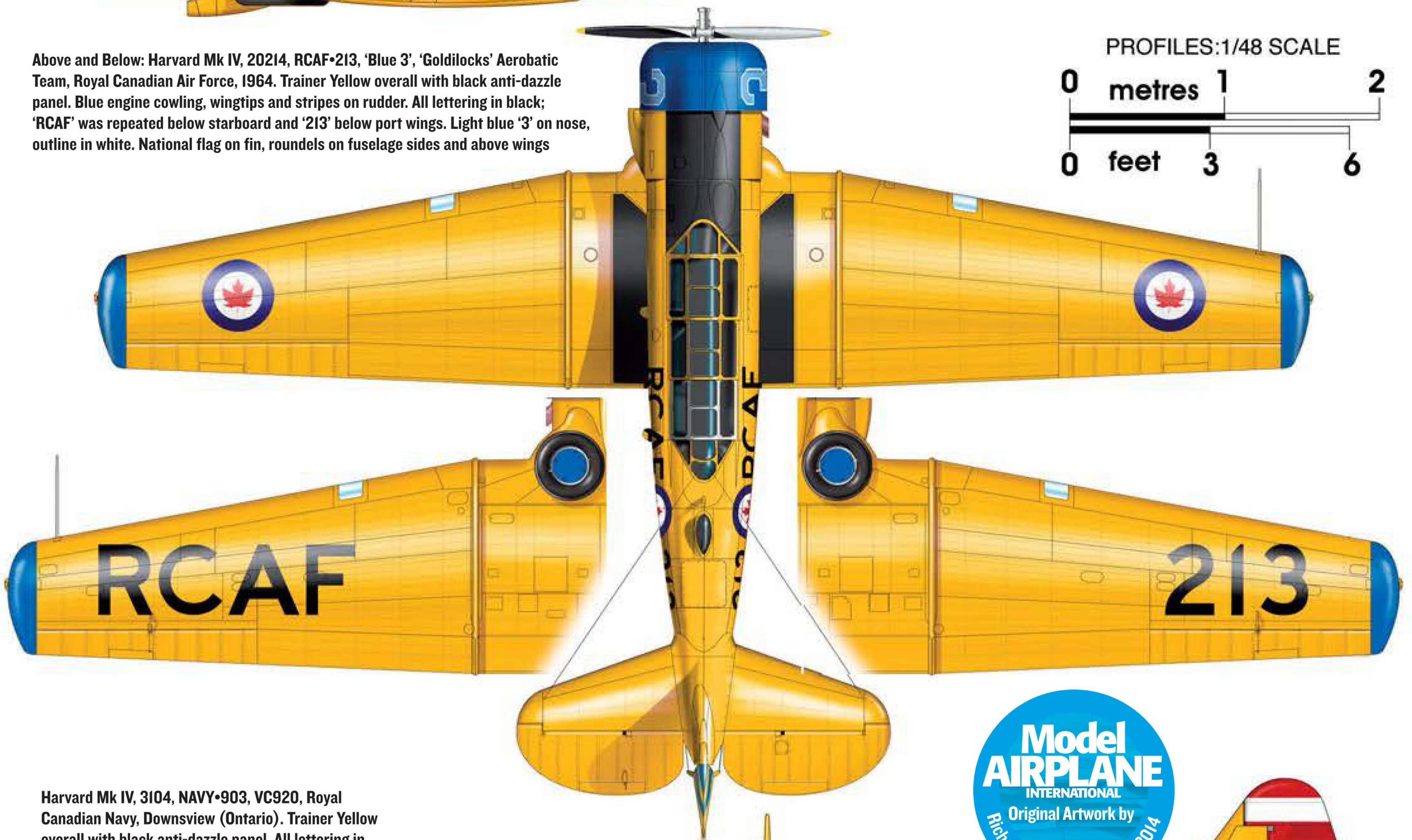
Harvard Mk II, 2815, OJ•815, 'A' Flight, No.4 FTS Royal Canadian Air Force, Penhold (Alberta), 1957. Trainer Yellow overall with black anti-dazzle panel. All lettering in black. National markings in six positions, with code '815' repeated below the wings. Unit badge on nose, dark blue wingtips

Harvard Mk II, 3308, DK•W, No.31 SFTS, Royal Canadian Air Force, Kingston (Ontario). Trainer Yellow overall with black anti-dazzle panel. Black checks on fin. All lettering in black with '3308' repeated below the wings. National markings in six positions

Harvard IV (T-6J), 20449, RCAFF•449, Goldilocks Aerobatic Team, No.1 FTS Royal Canadian Air Force, Trenton (Ontario), 1961. Trainer Yellow overall with red nose, wingtips and fin. All lettering in black. Code '449' repeated below wings. Wheel hubs in medium blue. National flag, outlined in white, on fin



Above and Below: Harvard Mk IV, 20214, RCAF•213, 'Blue 3', 'Goldilocks' Aerobatic Team, Royal Canadian Air Force, 1964. Trainer Yellow overall with black anti-dazzle panel. Blue engine cowling, wingtips and stripes on rudder. All lettering in black; 'RCAF' was repeated below starboard and '213' below port wings. Light blue '3' on nose, outline in white. National flag on fin, roundels on fuselage sides and above wings



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Harvard Mk IV, 3104, NAVY•903, VC920, Royal Canadian Navy, Downsview (Ontario). Trainer Yellow overall with black anti-dazzle panel. All lettering in black. Red/white striped rudder, red engine cowling. National markings in six positions with code '903' repeated below wings

THE 'HOG'

WHEN THE F-84 APPEARED IN KOREA, IT REPRESENTED THE FIRST JET FIGHTER FROM A LINE OF FORMIDABLE AIRCRAFT THAT WERE TO CARRY THE WORD 'THUNDER' AS PART OF THEIR NAME. ORIGINALLY, REPUBLIC AIRCRAFT CORPORATION HAD CONSIDERED THE IDEA OF MATING A JET ENGINE TO THE P-47 THUNDERBOLT FRAME BUT THIS SOON PROVED TO BE AN IMPOSSIBLE VENTURE. INSTEAD THE F-84 FAMILY WAS BORN, ALL BEARING THE DISTINCTIVE COKE-BOTTLE FUSELAGE, A NEW RANGE OF FIGHTERS AND FIGHTER-BOMBERS THAT BECAME AFFECTIONATELY KNOWN AS THE 'HOG' FAMILY, THAT ENDED WITH THE ULTIMATE HOG: THE F-105 THUNDERCHIEF.

Republic F-84G-1-Rem S/No.51-767 carrying the nose code FS-767-A has the refuelling receptacle doors in the port wing leading edge shown in the open position. Also clearly visible are the features that distinguish it from the previous 'E' model, namely the framed cockpit canopy that was retrofitted to all previous production aircraft (Photo: Republic)

Republic's effort in creating the F-84 lineage was undoubtedly its most important achievement in the race to enter the jet-age and especially the fighter aircraft market. It was born out of a proposal by Republic Aviation in November 1944 in reply to a General Operational Requirement calling for a mid-wing day fighter aircraft with a speed of 600mph and having an operational radius of 850 miles. It was to be powered by a General Electric TG-180 (J35) engine. Owing to several design difficulties (not to mention financial problems) at Republic, together with the delay in the development of the J35 engine, the first prototype mock-up was only unveiled at Farmingdale in February 1945. It found immediate approval by the Army Air Force and a contract for 25 test machines (YP-84s) and 75 production aircraft (P-84s) was immediately placed, though later ten of the test machines were transferred to the production list. The XP-84's first flight on 28 February 1946 at Muroc Dry Lake (California) also marked the first flight for the J35 jet engine. A second prototype was ready by August and in September the XP-84 set up a new US speed record of 611mph, just 5mph short of the World Speed Record then held by the Gloster Meteor.

The YP-84s of the pre-production batch (S/Nos.45-59482-96) were powered by the J35-A-15 rated at 4,000lb, carried an armament of six Colt-Browning M2 0.5in machine guns, four in the nose and one in each wing root. Improvements were also made to the wheel brakes, ventral airbrakes and a good number of other minor details. The Army placed further contracts, but soon cut these back from 271 to 191. Due to the teething troubles Republic were experiencing with the new fighter, the money was invested in procuring P-80 Shooting Stars. Late in 1946 the P-84 was officially named 'Thunderjet' and in August of the following year the first production models (P-84Bs, as the 'A' suffix was restricted to the test aircraft) began to join United States Army Air Force (USAAF) units, the first of which was the 14th Fighter Group at Dow Field in November 1947. This model introduced improvements to the cockpit such as air conditioning and an ejection seat. Two 230USgall tanks were added to the wing tips, features that were to become a standard. The guns were changed to the M3 that had a rate of fire of 1,200 rounds per minute. By that time, the USAF had became a separate entity from the Army, and one of its first provisions was to change the 'Pursuit' term to 'Fighter'. This also brought about a change in nomenclature, as the 'P' prefix then in use was changed to 'F'. All did not go smoothly with the Thunderjet as it was faced with stringent restrictions imposed by problems that had become apparent whilst units were working up to operational status. The situation worsened soon afterwards when it was realised that spare parts were in short supply, prompting aircraft maintenance personnel in service to dub the aircraft as the "Mechanic's Nightmare". The last straw, it seems, was when the entire F-84B fleet was grounded in May 1948 following serious structural problems. The next version in line, the F-84C, was powered by the earlier J35-A-13 rather than the -15 engine, because it was found to be more compatible with the mission profile of the new fighter. Probably the only credit that the new model could lay claim upon was that it was the first of its type to be

'Hog', S/No.51-10530 in Korea, where the type earned its fame as a most efficient fighter-bomber. It is an F-84G-16-RE, which was the most-built production version of all F-84Gs (Photo: R.J. Caruana Archives)

sent to see action when it was sent to Korea, but more about that later. Another engine change, this time to the J35-A-17D, brought about the F-84D model which featured a strengthened airframe. Slowly but surely the Thunderjet was being moulded into a real fighting machine, with more refinements being applied to the F-84E. The latter was lengthened by 12 inches in the cockpit section, Jet Assisted Take Off (JATO) rockets could also be fitted in a retractable bay in the rear fuselage, and it was fitted with a Sperry A-1B radar gunsight. For the first time, the F-84 lived up to its design specification and surpassed the 600mph threshold.

A Real Jet Fighter-Bomber

The F-84E was supposed to be the last straight-winged fighter in this series, as the F-84F was designed from the outset to have swept wings. However at that time Republic encountered further problems. The USAF could not wait for the new F-84F, so a stop-gap fighter-bomber had to be found, one that would also be capable of carrying a nuclear weapon. Thus the F-84G was born, a version that was to be produced in greater numbers than all those produced thus far as production of the 'G' model totalled 3,025 examples. Of these, 789 went into service with the USAF, while 2,236 were supplied to foreign nations under the terms of the Mutual Defence Assistance Program.

The F-84G possessed a number of unique features. It was the first fighter to incorporate facilities for in-flight refuelling using Boeing's Flying Boom system, apart from being the first single-seat fighter that could carry a nuclear weapon. It was proved to be far superior to its predecessors, mainly thanks to its more reliable J35-A-29 engine, which produced 5,600lb thrust. Maximum speed increased to 622mph whilst unrefuelled range also increased to 2,000miles. The one-piece teardrop cockpit canopy was reinforced with the addition of external frames, a feature that was eventually retrofitted to all other F-84 models still in service.

By August 1951, the new fighter-bomber was ready for delivery, as the first examples reached the 31st Fighter Escort Wing at Turner Air Force Base (AFB) in Georgia. It was however in Korea that the 'Hog' was to win its spurs.

Over Korean Skies

Though no match to the MiG-15, the F-84G was faster and capable of carrying heavier loads than the F-80 Shooting Star which, up to that time, had taken the brunt of the fighting in Korea. Soon the F-84G proved to be the best aircraft to beef up the fighter-bomber forces in the Korean peninsula. The Far Eastern Air Force (FEAF) asked for as many squadrons of F-84Gs as the Joint Chiefs of Staff would allow it to have and the 27th Fighter Escort Wing (FEW) was immediately deployed to Korea where it flew its first mission on 6 December 1951. As soon as the F-84G confirmed its footing in the battle zone, FEAF retired the ageing F-51D Mustangs. Thunderjets, accompanied by F-86 Sabres as top cover, flew all the strategic interdiction missions into northern territory and especially North West Korea – better known as 'MiG Alley'. By the middle of 1952, FEAF had three F-84G Wings flying combat missions, the 136th Fighter Bomber Group (FBG) that had replaced the 27th FEW, the 116th FBG and the 49th Fighter Bomber Wing (FBW) that traded its F-80 Shooting Stars for F-84s in Spring of that year. It was these three units which earned fame through their rail busting missions. On a typical mission they would be armed with two 1,000lb bombs; they would fly north to the target, drop 400 to 500 bombs on the tracks and return home. Though this inflicted heavy damage, the North Koreans possessed an impressive workforce that could repair such damage within days, so off again went the Thunderjets to bust the rails once more, in a never-ending cycle! Starting from May of 1952 a new feature entered tactical air warfare – in-flight refuelling, a factor for which the Thunderjets were adequately prepared. On 23 June, a combined FEAF and NavFE effort was launched on North Korean power plants. A force of 79 Thunderjets dropped 145 tons of bombs on Suiho. After four days and 1,276 sorties, ninety percent of North Korean power potential had been destroyed and a complete blackout was in effect for over two weeks. Losses for F-84 units during the entire Korean conflict were, however, considerable; of

S/No.51-10603 is a Republic F-84G-16-RE serving with the Royal Danish Air Force
(Photo: R.J. Caruana Archives)

A pair of Netherlands Air Force F-84s fly in formation coded TB-9 and TB-19. The blue rudder stripes and wingtip tank flashes are distinguishing features of No 315 Squadron aircraft based at Eindhoven Air Base
(Photo: R.J. Caruana Archives)

the 335 aircraft of this type lost in Korea more than half were victims of ground fire.

The F-84G story in USAF service did not end there, for the aircraft eventually joined the USAF in Europe. For that purpose the 20th FBG was transferred to Wethersfield early in June 1952, comprising the 55th, 77th and 79th Fighter Bomber Squadrons (FBS) serving there until 1955 when the straight-winged F-84G was replaced by the swept-wing F-84F. As more modern aircraft began to take over from the Thunderjet, the F-84 was handed over to reserve units, principally those of the Air National Guard where they remained in service up to 1960. Also to be remembered is the use of the F-84G as the first mount of the famous 'Thunderbirds' aerobatic team of the USAF between 1953 and 1955.

Thunderjets in Foreign Service

At a fly-away price of just over $300,000 including engine and armament, the F-84G was by contemporary standards extremely good value for money, especially considering all the development that had gone into it. It's not surprising therefore that it became a very popular aircraft when offered to Nato countries in the early fifties under the Mutual Defence Assistance Program (MDAP). In fact Britain, Spain and West Germany were the only European countries that never had the F-84 on their inventory. Two countries outside NATO, but within the South East Asia Treaty Organisation (SEATO), received this jet fighter, namely Thailand and Nationalist China, the latter using the F-84G in action when it opposed Red Chinese Air Force aircraft over the Formosan Strait throughout the mid-fifties.

The F-84G Thunderjet's service with air forces in Europe was relatively short and mostly uneventful, with few exceptions. In Italy, the F-84G marked an important step forward in the formation of the post-war Aeronautica Militare Italiana (AMI) providing a quantum leap to its units. Moreover, the Thunderjet was so eagerly awaited and accepted that Italian pilots even formed their first jet aerobatic display teams of the post-war period on the type. The 5° Stormo was first to receive the F-84G at Villafranca early in 1953 followed by the 6° Aerobrigata at Ghedi and the 51° Stormo based at Aviano (later transferred to Istrana). With the official introduction into service of the Thunderjet on 1 February 1953 the AMI also reviewed the composition of its units when Stormi became known as Aerobrigate modelled on the American 'Wing'. First in a series of aerobatic display teams was the 5^ Aerobrigata with the 'Getti Tonanti' in 1953/54 (Thunder Jets) a team that performed even outside Italy with great success. During the following two years it was the turn of the 51^ Aerobrigata and its 'Tigri Bianche' (White Tigers), who performed their last display at an open day at Teviso on 4 November 1956, this also marking the retirement of the type from AMI service.

Another country whose Thunderjets are well remembered through displays by its aerobatic teams is Portugal where 25 brand new F-84Gs arrived on 25th January 1953. Esquadra 20 began working up with the type replacing Spitfires the following May, and was eventually to form four flights. A second Thunderjet unit, Esquadra 21, was formed when a further batch of aircraft arrived in Portugal. Members from the former unit formed the first aerobatic team known as the 'Dragóes de Portugal' (Dragons of Portugal) performing an inaugural display on 30th November 1954. Of interest is their participation in a NATO aerobatic team contest in June 1958, where they placed second behind Italy's 'Diavoli Rossi' (Red Devils), the latter flying the new F-84Fs. Another team followed, this time named 'Sao Jorge' (Saint George). It is worth noting that Portuguese Thunderjets were to see action in Angola from the second half of 1962, remaining there until the type was retired as late as 1973.

The 'Hog' was by no means an outstanding aircraft and was quickly overshadowed by its stablemate the F-84F and the F-86 Sabre. Notwithstanding its troubled early development the F-84G justified the faith placed in it by the USAF and went on to complete impressive records, not only with the US Forces but also with the air forces of NATO and other 'allies' well into the late 'fifties. ●

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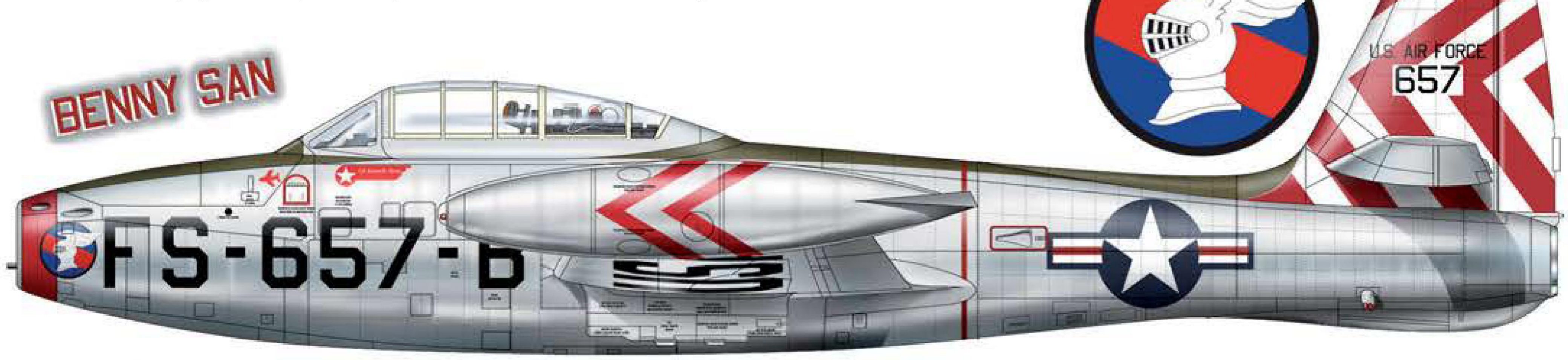
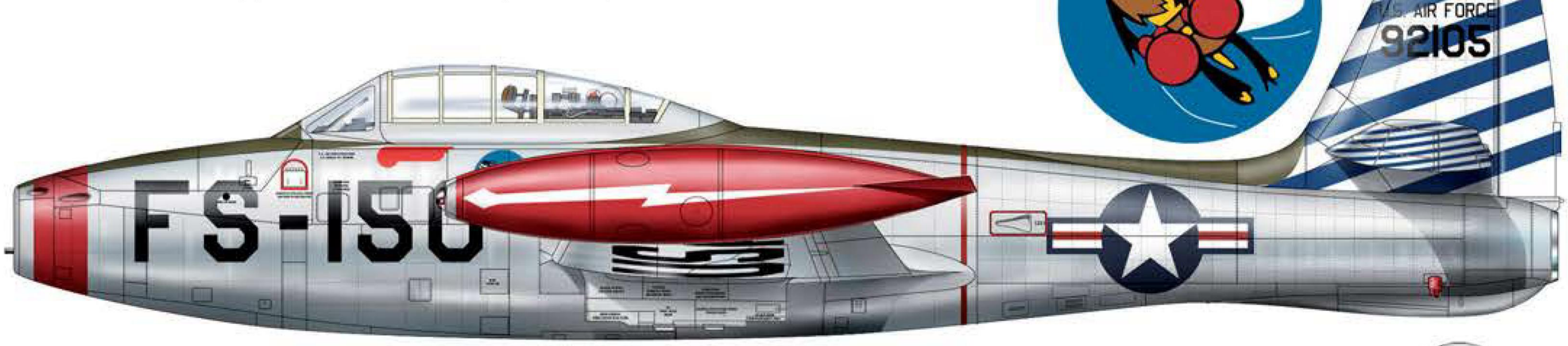
Acknowledgements: My thanks to Roberto Zambon for updating my information on the Italian F-84G teams through his knowledgeable research

Republic F-84E-30-RE Thunderjet, FS-657-B, flown by Capt Kenneth Skeen, 9th FBS, 49th FBW, USAF, Daegu Air Base (K-2), 1951. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage decking; red/white vertical tail surfaces, red chevrons on wingtip tanks, red nose band. All lettering in black; one MiG-19 kill marking (scored 19 September 1951) on nose. Pilot's name in white on red flash carrying a white star; name 'Benny San' carried on starboard side. Unit badge on nose



Republic F-84E-30-RE Thunderjet, S/No.51-619, FS-619-A, 159th FBS, 116th FG, USAF, Misawa AFB, late 1951. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage decking; all lettering in black. Blue bands around vertical tail surfaces, rear fuselage and nose

Republic F-84E-1-RE Thunderjet, S/No.49-2105, FS-150, 22nd FBS, 36th FBW, USAF, Furstenfeldbruck Air Base, Germany. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage decking; vertical and horizontal tail surfaces white with blue stripes. All lettering in black; red nose band, red wingtip tanks with white flash. Unit badge below cockpit



Republic F-84E-25-RE Thunderjet, S/No.51-493, FS-493-B, flown by Lt Jacob Kratt of the 532nd FBS, 27th FBG, USAF, 1951. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage top decking; all lettering in black. Yellow bands on fin and horizontal tail surfaces; yellow nose and arrow on wingtip tanks. Three red star kills below cockpit

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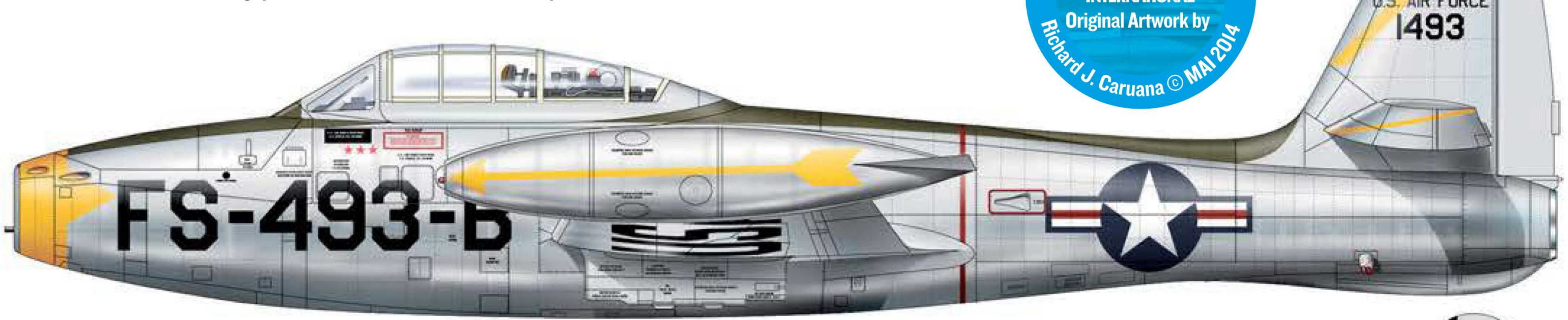
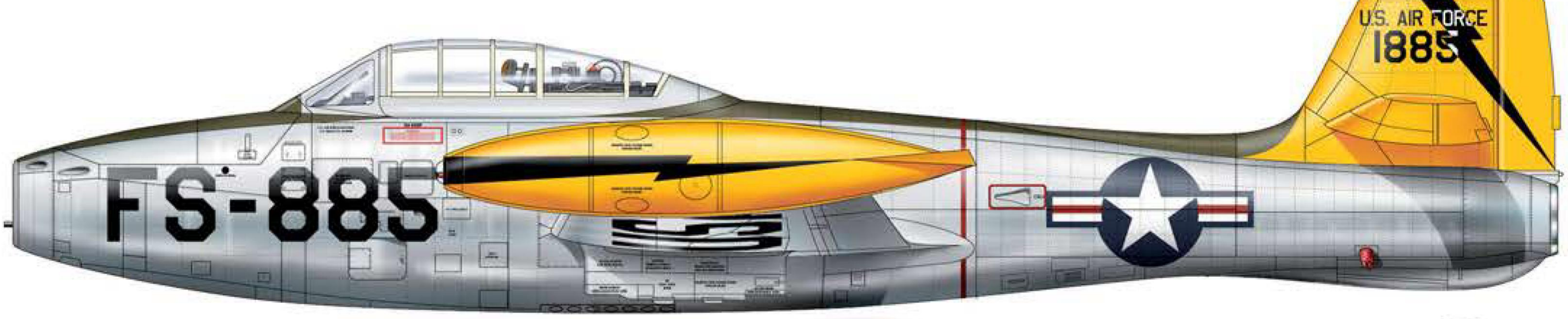


Republic F-84E-30-RE Thunderjet, S/No.51-613, FS-613-A, 'Frenchie, Lois K.', 8th FBS, 49th FBG, USAF, Kunsan, 1953. Natural metal overall with yellow/black vertical tail surfaces; all lettering in black except USAF script in red on rudder. Yellow nose band, yellow/black chevrons on wingtip tanks; name in golden yellow on fuselage just aft and above 'A' of nose code

Lois K.

Republic F-84E-30-RE Thunderjet, S/No.51-651, FS-651-B, 9th FBS, 49th FBW, USAF, Taegu (Korea) 1953. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage top decking. Red trim to nose. Red/white trim to wintip tanks and vertical tail surfaces. Lettering in black, except 'Gerry' on nose which is red. Note name "Baby Doll" partly hidden behind the wingtip tank

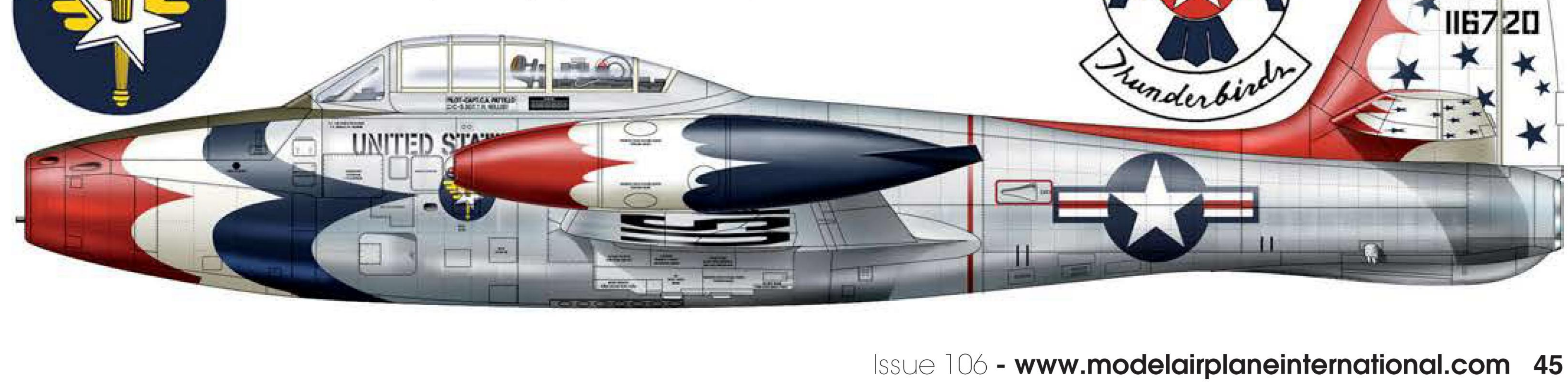
Republic F-84G-1-RE, Thunderjet, S/No.51-885, FS-885, 493rd FBS, 48th BG USAF. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage decking. Yellow vertical and horizontal tail surfaces with black flash and lettering, except over the flash where the lettering is white. Yellow wingtips with black flash. Code on nose in black



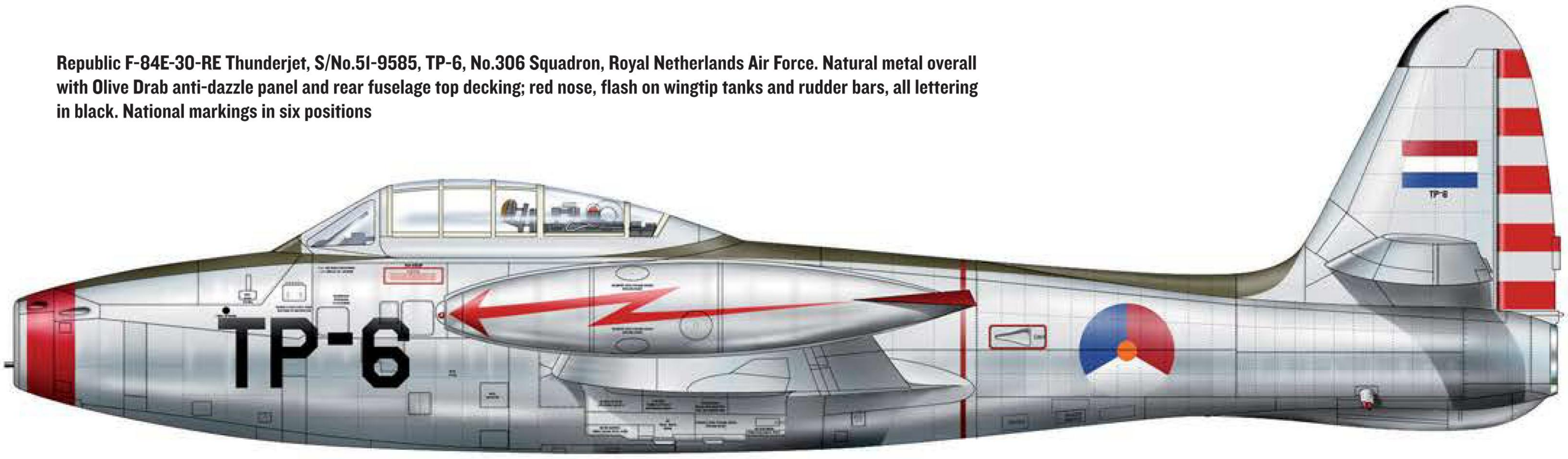
Republic F-84G-16-RE Thunderjet, S/No.51-10454, FS-454, flown by Col. Joe Davis Jr, 58th FBW, USAF, Korea, 1952. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage to decking. Red/yellow/blue trim to nose and rear fuselage, edged in black. Red/yellow/blue trim to vertical and horizontal tail surfaces, and wingtip tanks. Codes in black with red drop shadow. Pilot's name on cockpit framing, personal 'Four Queens' marking on the fuselage just beneath the cockpit

Republic F-84G-26-RE Thunderjet, S/No.51-10437, FS-437, flown by Col. Charles Jordan, Commander 58th FBW, USAF, Taegu (Korea}, 1952. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage top decking. Blue/yellow/red trim to nose, wingtip tanks and vertical tail surfaces. All lettering in black. "Night Take-Off" art appears on port (behind wingtip tanks}; "Ruth" was carried on starboard

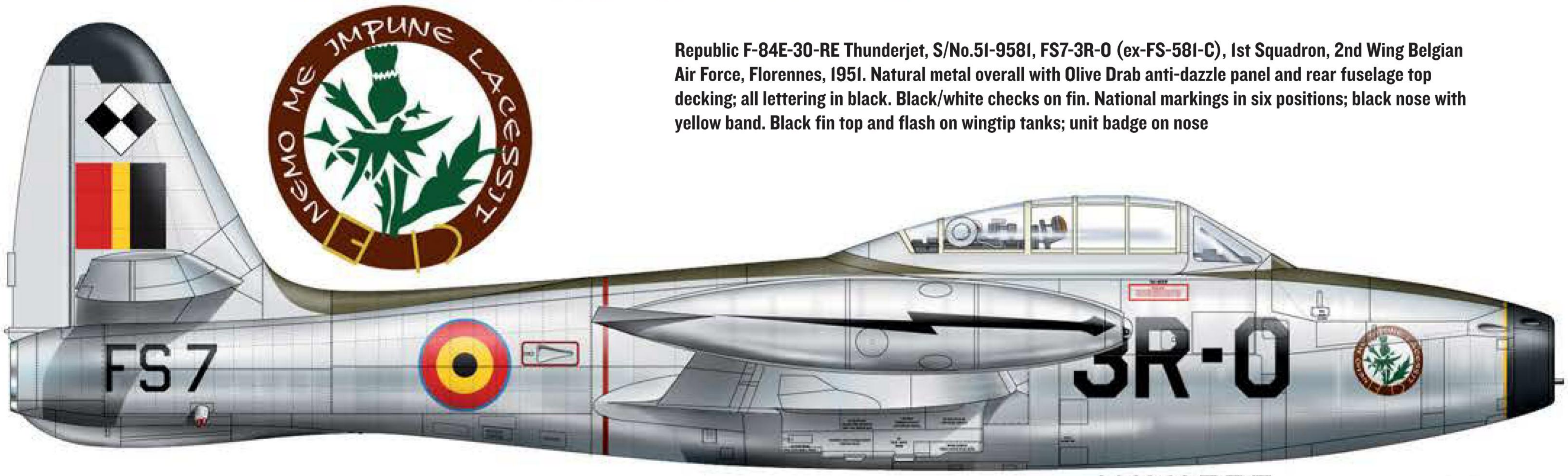
Republic F-84G-26-RE Thunderjet, S/No.51-16720, Flown by Capt C.A. Pattillo, original mount of the 'Thunderbirds' USAF Aerobatic Team in the scheme worn up to October 1954. Natural metal overall with Olive Drab anti-dazzle panel. Red/white/blue trim to nose, tail surfaces and wingtip tanks. All lettering in black. The 'winged torch' emblem, originally carried on both sides was replaced in October 1954 by the official 'Thunderbird' logo on the starboard side and a panel showing flags of countries visited on port



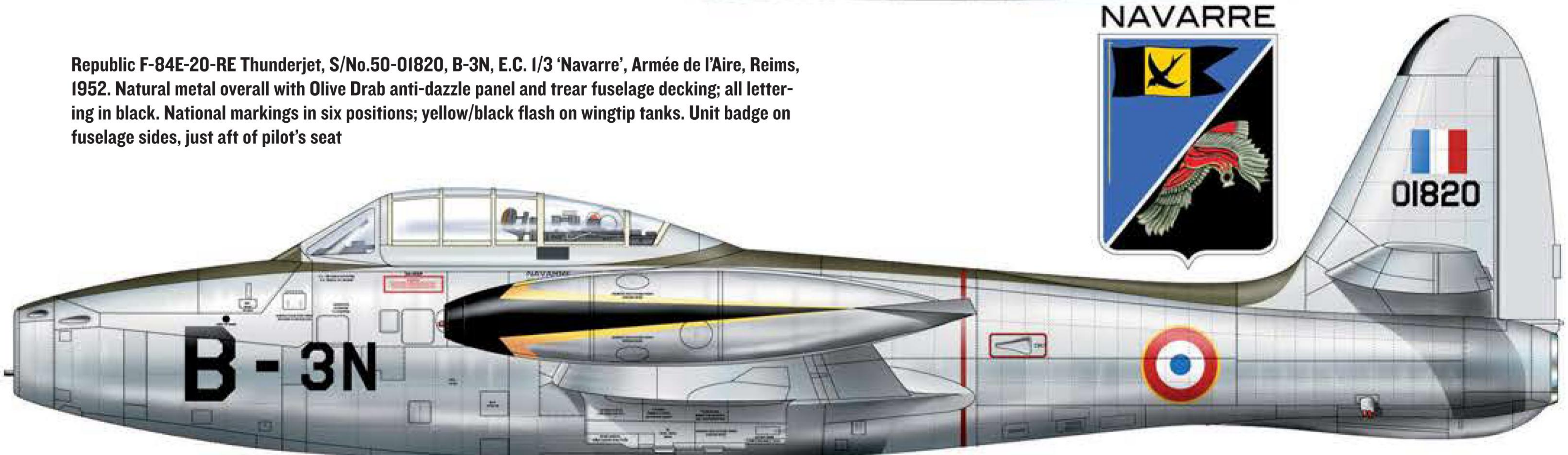
Republic F-84E-30-RE Thunderjet, S/No.51-9585, TP-6, No.306 Squadron, Royal Netherlands Air Force. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage top decking; red nose, flash on wingtip tanks and rudder bars, all lettering in black. National markings in six positions



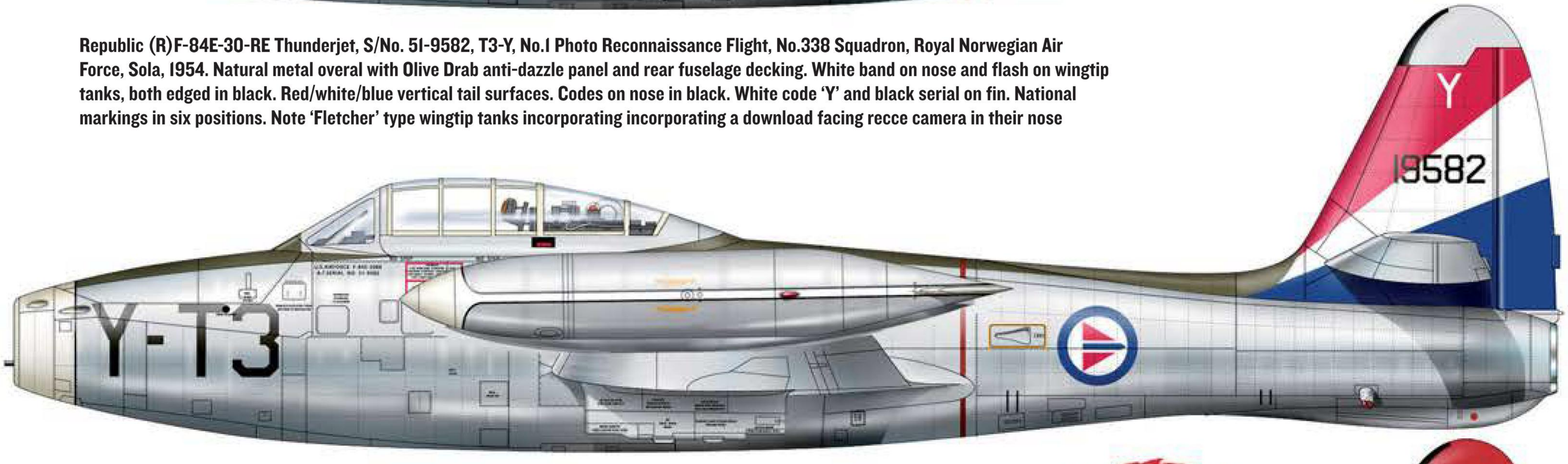
Republic F-84E-30-RE Thunderjet, S/No.51-9581, FS7-3R-O (ex-FS-581-C), 1st Squadron, 2nd Wing Belgian Air Force, Florennes, 1951. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage top decking; all lettering in black. Black/white checks on fin. National markings in six positions; black nose with yellow band. Black fin top and flash on wingtip tanks; unit badge on nose



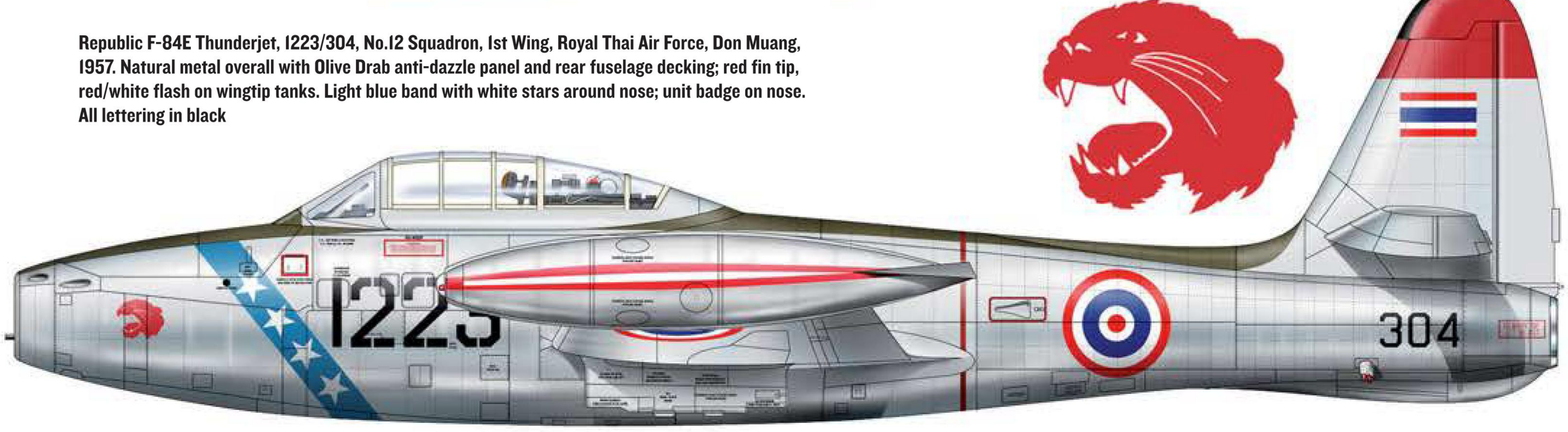
Republic F-84E-20-RE Thunderjet, S/No.50-01820, B-3N, E.C. 1/3 'Navarre', Armée de l'Aire, Reims, 1952. Natural metal overall with Olive Drab anti-dazzle panel and trear fuselage decking; all lettering in black. National markings in six positions; yellow/black flash on wingtip tanks. Unit badge on fuselage sides, just aft of pilot's seat

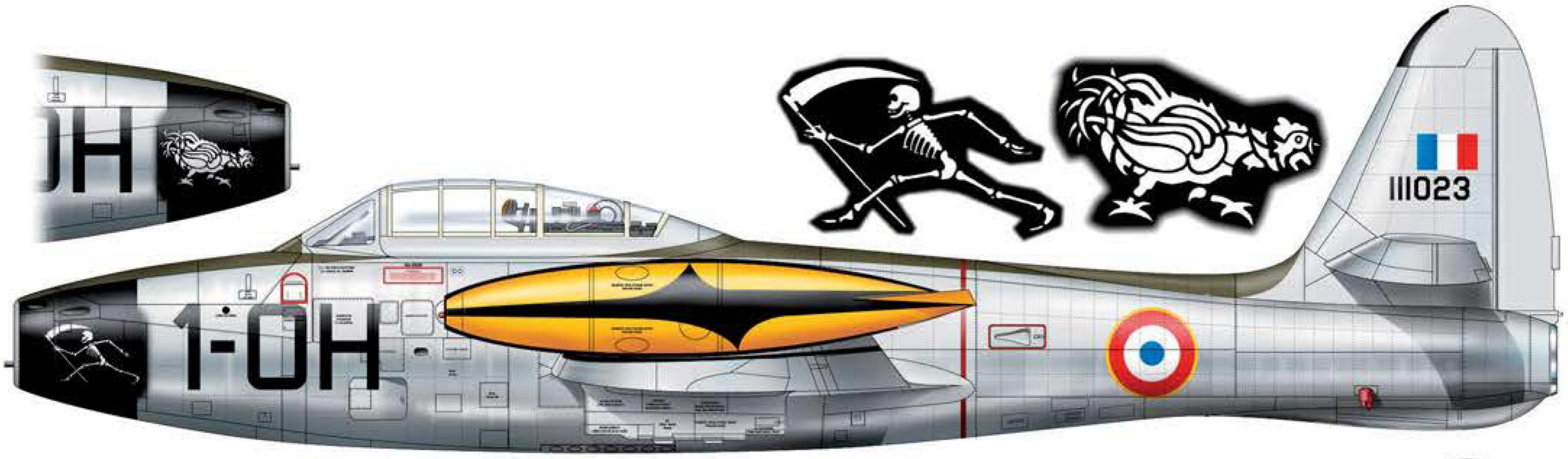


Republic (R)F-84E-30-RE Thunderjet, S/No. 51-9582, T3-Y, No.1 Photo Reconnaissance Flight, No.338 Squadron, Royal Norwegian Air Force, Sola, 1954. Natural metal overal with Olive Drab anti-dazzle panel and rear fuselage decking. White band on nose and flash on wingtip tanks, both edged in black. Red/white/blue vertical tail surfaces. Codes on nose in black. White code 'Y' and black serial on fin. National markings in six positions. Note 'Fletcher' type wingtip tanks incorporating incorporating a download facing recce camera in their nose



Republic F-84E Thunderjet, 1223/304, No.12 Squadron, 1st Wing, Royal Thai Air Force, Don Muang, 1957. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage decking; red fin tip, red/white flash on wingtip tanks. Light blue band with white stars around nose; unit badge on nose. All lettering in black



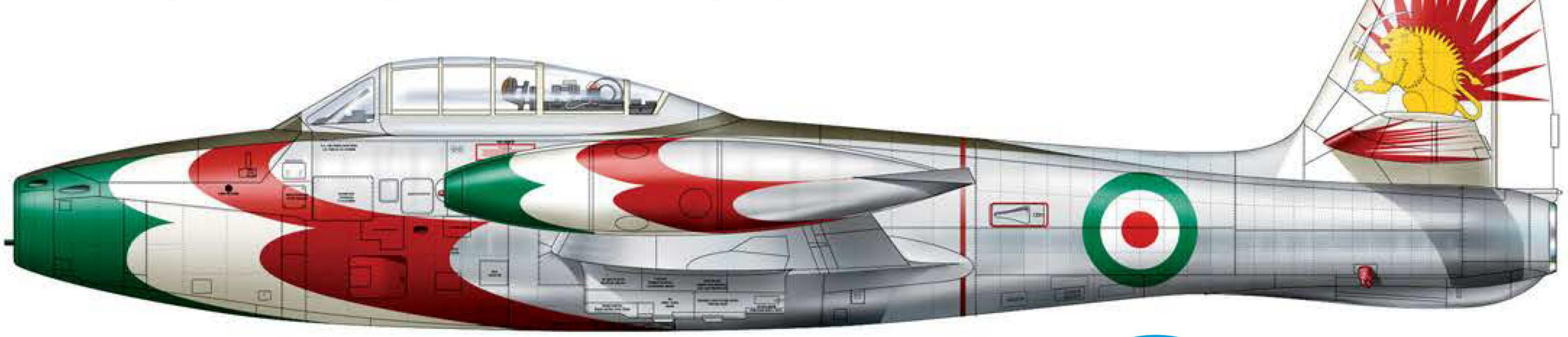


Above: Republic F-84G-11-RE Thunderjet, S/No.51-11023, 1-OH, EC1/2, Armee de l'Air, late 1953. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage top decking. Black nose area with both unit markings on either side. Black lettering and chordwise wing band. Yellow wingtip tanks with black flash superimposed

Below: Republic (R)F-84G Thunderjet, KA-D, 729th Reconaissance Flight, Royal Danish Air Force, Karup AB, 1957. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage top decking. Green/black rudder; green/black wingtip tanks with white flash superimposed. National markings in six positions

Republic F-84G-5-RE Thunderjet, 998 (51-998), Hellenic Acro Team, 337th MDB, 110PM, Polemikí Aeroporía (Hellenic Air Force). 'Blue Angles' Blue overall with white/medium blue bands around nose, vertical tail surfaces and wings. National markings on fuselage sides only. Code '998' in red on fuselage sides. Unit badge on nose (both sides)

Republic F-84G-30-RE Thunderjet, S/No.52-3259. 5, 'Golden Crown' Aerobatic Team, Imperial Iranian Air Force, Mehrabad AB, 1959. Natural metal overall with green/white/red trim to nose section and wingtip tanks. White vertical tail surfaces with golden sun and lion over a red flash. White horizontal tail surfaces with red flashes above and below. National markings on fuselage sides, above port and below starboard wings. 'IIAF' in black above starboard and below port wings



Republic F-84G-16-RE, S/No.51-10571, 571, 88th Air Regiment, Yugoslav Air Force, Batajnica AB, 1962. Dark Sea Grey FS 26173 and Dark Green FS 24079 on upper surfaces with PRU Blue FS 25189 undersides. Codes and serials in black. National markings on fuselage sides, above port and below starboard wings. '571' repeated in black above starboard and below port wings

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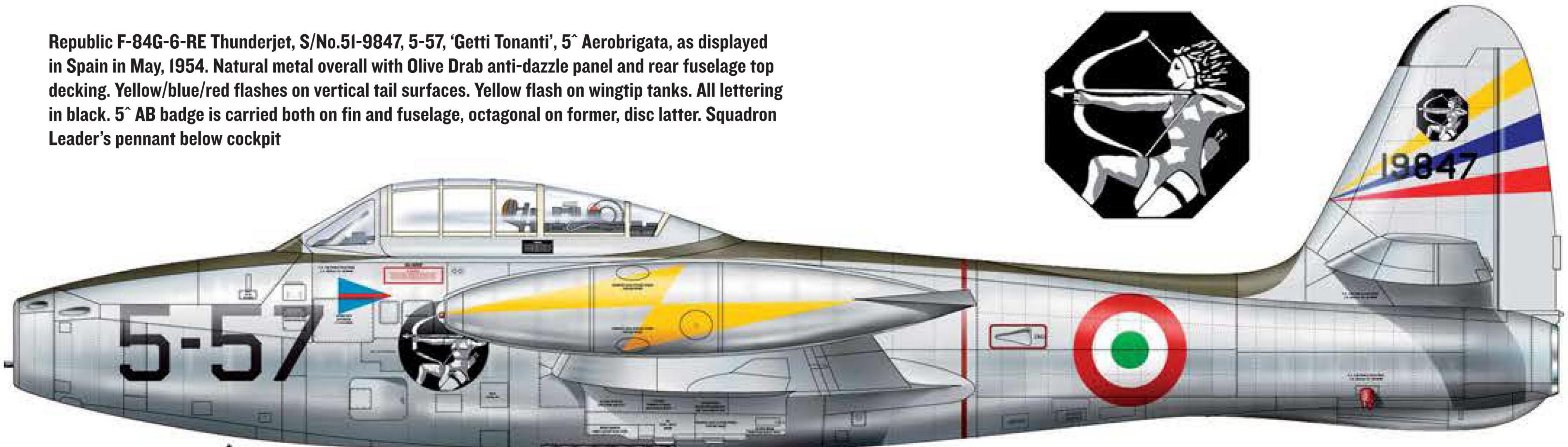
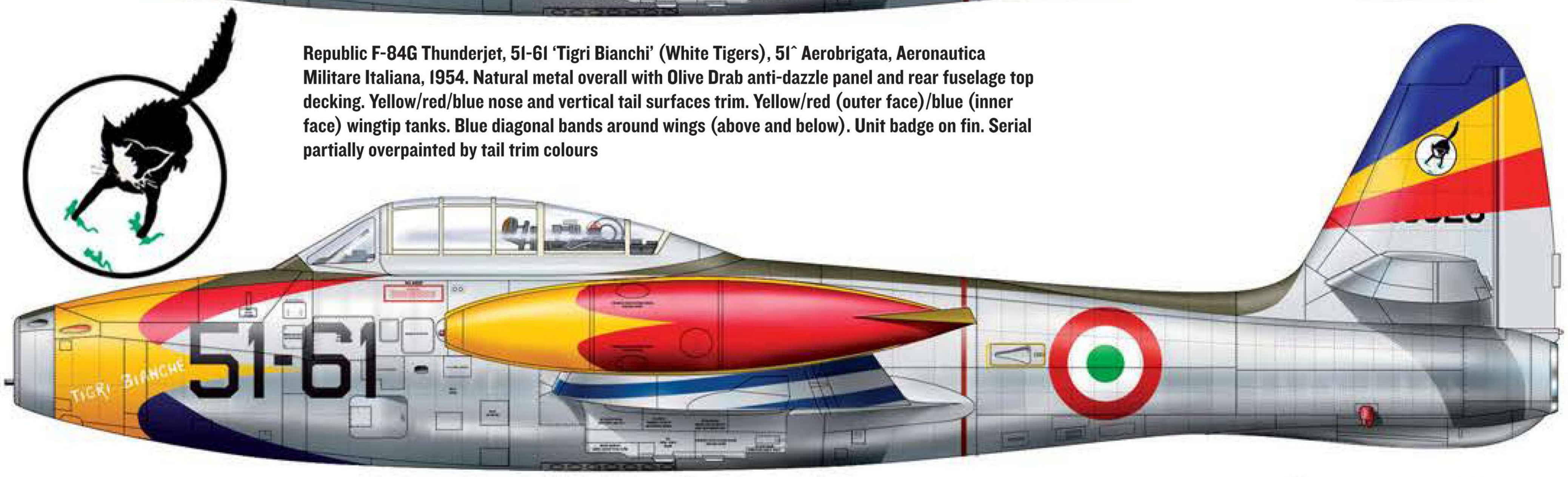
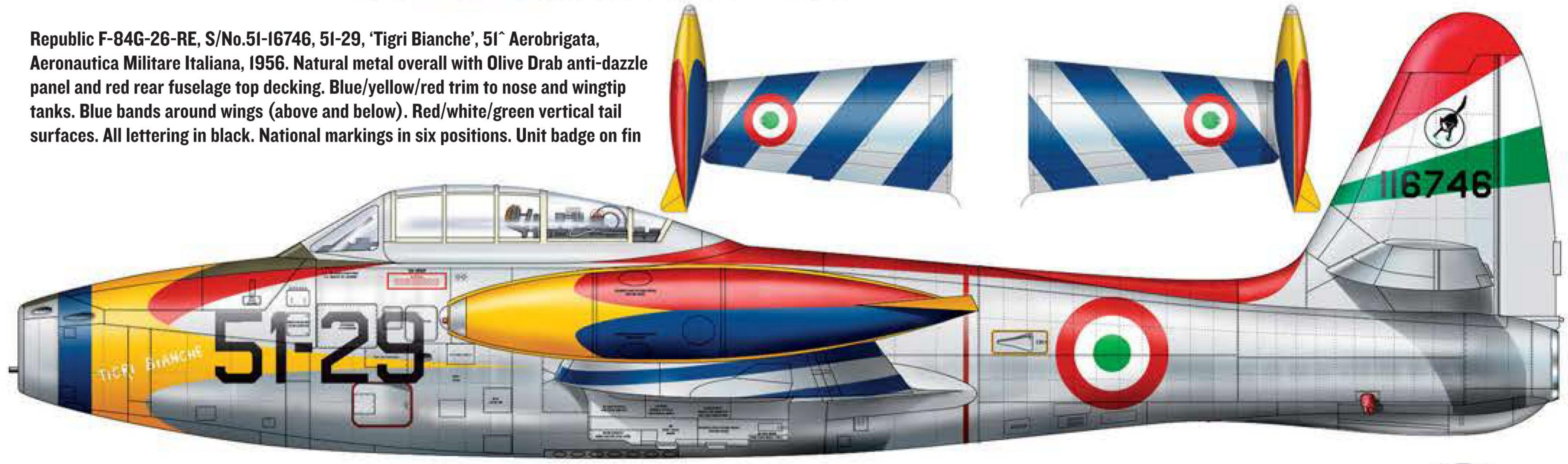
Republic F-84G-6-RE Thunderjet, S/No.51-9847, 5-57, 'Getti Tonanti', 5^ Aerobrigata, as displayed in Spain in May, 1954. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage top decking. Yellow/blue/red flashes on vertical tail surfaces. Yellow flash on wingtip tanks. All lettering in black. 5^ AB badge is carried both on fin and fuselage, octagonal on former, disc latter. Squadron Leader's pennant below cockpit



Republic F-84G Thunderjet, 51-61 'Tigri Bianchi' (White Tigers), 51^ Aerobrigata, Aeronautica Militare Italiana, 1954. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage top decking. Yellow/red/blue nose and vertical tail surfaces trim. Yellow/red (outer face)/blue (inner face) wingtip tanks. Blue diagonal bands around wings (above and below). Unit badge on fin. Serial partially overpainted by tail trim colours



Republic F-84G-26-RE, S/No.51-16746, 51-29, 'Tigri Bianche', 51^ Aerobrigata, Aeronautica Militare Italiana, 1956. Natural metal overall with Olive Drab anti-dazzle panel and red rear fuselage top decking. Blue/yellow/red trim to nose and wingtip tanks. Blue bands around wings (above and below). Red/white/green vertical tail surfaces. All lettering in black. National markings in six positions. Unit badge on fin



Republic F-84G-21-RE Thunderjet, FAP-5172 (ex-S/No.51-10878), Fuerza Aerea Portuguesa, 1957. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage top decking. Black/white trim to nose, front fuselage sides, wingtips, rear fuselage and fin leading edge. Lettering in black. National markings in six positions. Note blanked gun throughs

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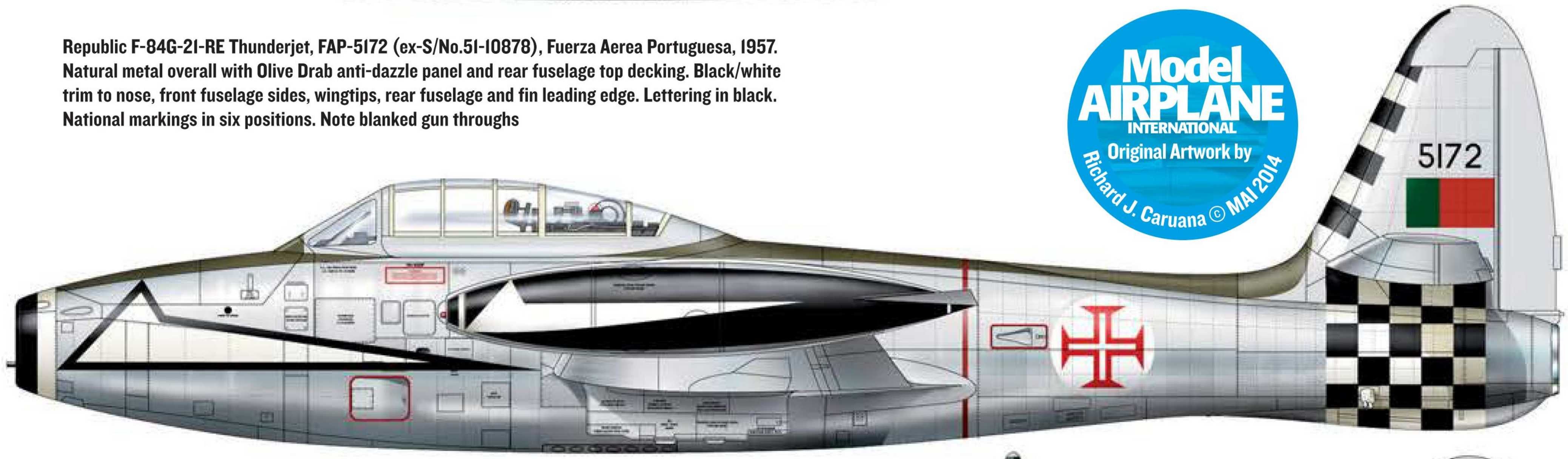

Republic F-84G-10-RE Thunderjet, FAP-5156 (ex-S/No. 51-1092), "Dragoes" Aerobatic team, Fuerza Aerea Portuguesa, June 1958. Natural metal overall with Olive Drab anti-dazzle panel and rear fuselage top decking. Green/whit/red trim to forward and rear fuselage; red nose and wingtips, the latter with black edges. Black code '187' on nose. National markings in six positions

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BRAND NEW TOOL
13
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MAY 2014

Hawker Hurricane Mk I, L1555, flown by Sqn Ldr J. Gillan, No.111 Squadron, Northolt, July 1938. Typical early scheme of Dark Earth/Dark Green/Aluminium; white '111' on fuselage sides and black 6 inch high serial on fuselage sides. Two-balded Watts prop and no ventral fin; unit crest on fin and rank pennant below cockpit

Hawker Hurricane Mk I, L1584, No.111 Squadron, during a visit to Villacoublay, France, July 1938. Typical early scheme of Dark Earth/Dark Green/Aluminium; red/white '111' on fuselage sides and black 6 inch high serial on fuselage sides. A1 roundels 35 inch diameter on fuselage, 49 inch diameter above wings; 45 inch diameter A roundels below wings with serial repeated in black, 30 inch high characters. Two-balded Watts prop and no ventral fin; unit crest on fin

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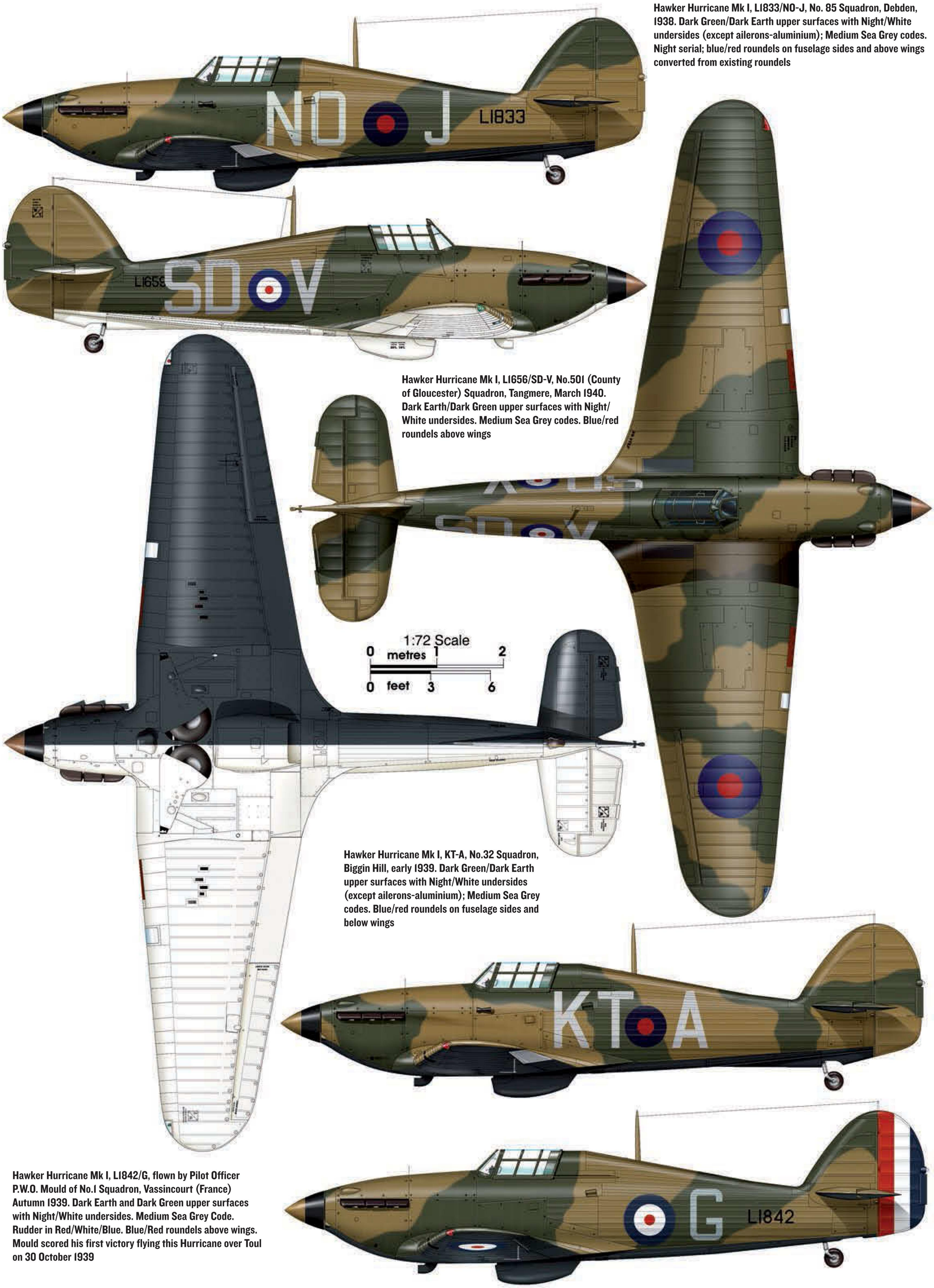
Far Right: Hawker Hurricane Mk I, NO-R (serial overpainted), No.85 Squadron, Debden, early 1939. Dark Earth/Dark Green/Aluminium finish with Medium Sea Grey codes; standard markings, with white of fuselage roundel toned down

Hawker Hurricane Mk I, L1599/L, No.56 Squadron, 1939. Dark Earth/Dark Green upper surfaces with Aluminium undersides; Night port wing, White starboard wing. Code 'L' on nose in white, serial in black. Type 'A1' roundels in bright colours on fuselage sides and above wings; unit badge on fin within a white spearhead



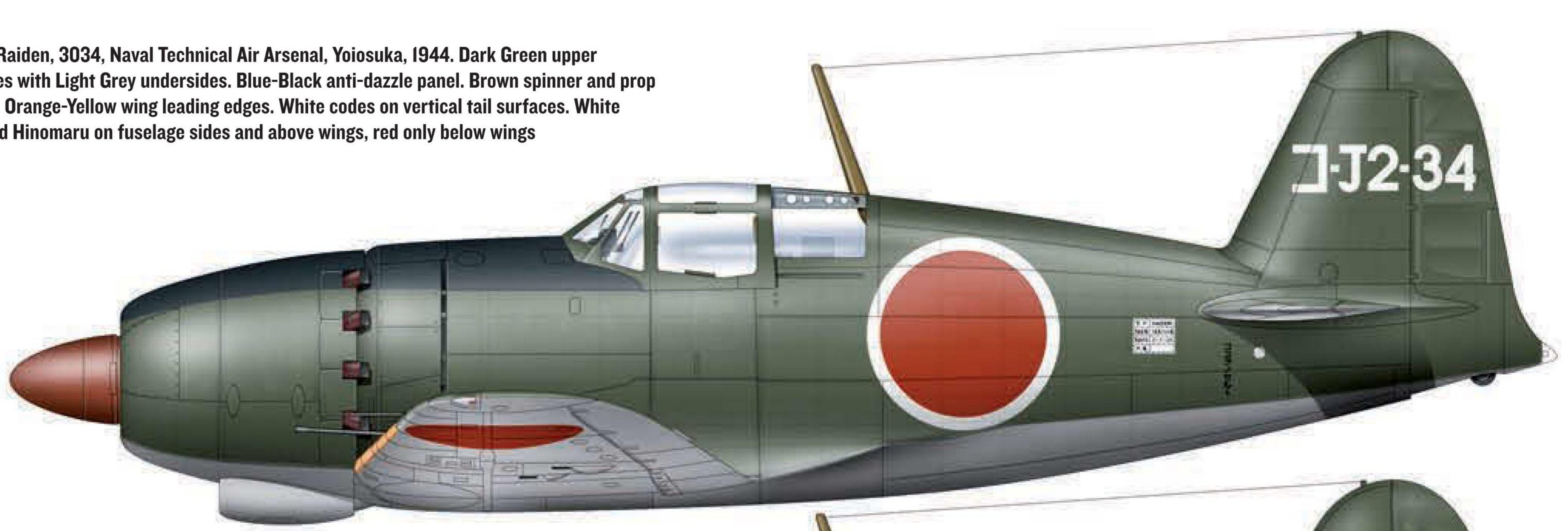
Hawker Hurricane Mk I, L1833/NO-J, No. 85 Squadron, Debden, 1938. Dark Green/Dark Earth upper surfaces with Night/White undersides (except ailerons-aluminium); Medium Sea Grey codes. Night serial; blue/red roundels on fuselage sides and above wings converted from existing roundels

Hawker Hurricane Mk I, L1656/SD-V, No.501 (County of Gloucester) Squadron, Tangmere, March 1940. Dark Earth/Dark Green upper surfaces with Night/White undersides. Medium Sea Grey codes. Blue/red roundels above wings

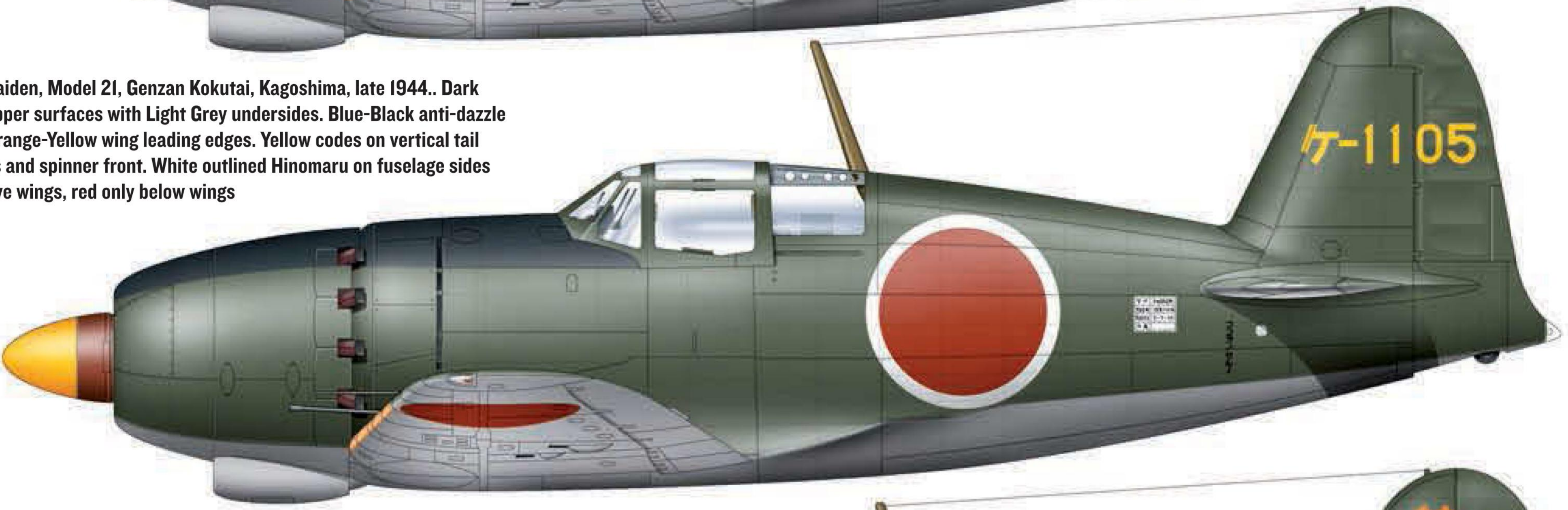
Hawker Hurricane Mk I, KT-A, No.32 Squadron, Biggin Hill, early 1939. Dark Green/Dark Earth upper surfaces with Night/White undersides (except ailerons-aluminium); Medium Sea Grey codes. Blue/red roundels on fuselage sides and below wings

Hawker Hurricane Mk I, L1842/G, flown by Pilot Officer P.W.O. Mould of No.1 Squadron, Vassincourt (France) Autumn 1939. Dark Earth and Dark Green upper surfaces with Night/White undersides. Medium Sea Grey Code. Rudder in Red/White/Blue. Blue/Red roundels above wings. Mould scored his first victory flying this Hurricane over Toul on 30 October 1939

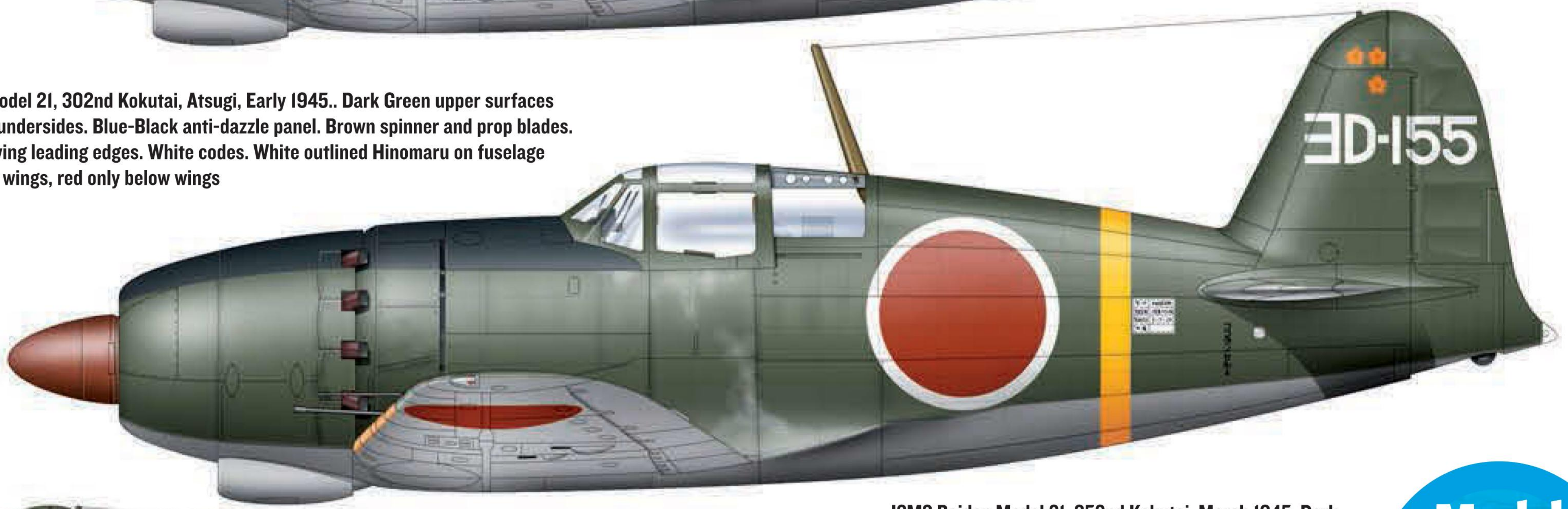
J2M3 Raiden, 3034, Naval Technical Air Arsenal, Yoiosuka, 1944. Dark Green upper surfaces with Light Grey undersides. Blue-Black anti-dazzle panel. Brown spinner and prop blades. Orange-Yellow wing leading edges. White codes on vertical tail surfaces. White outlined Hinomaru on fuselage sides and above wings, red only below wings



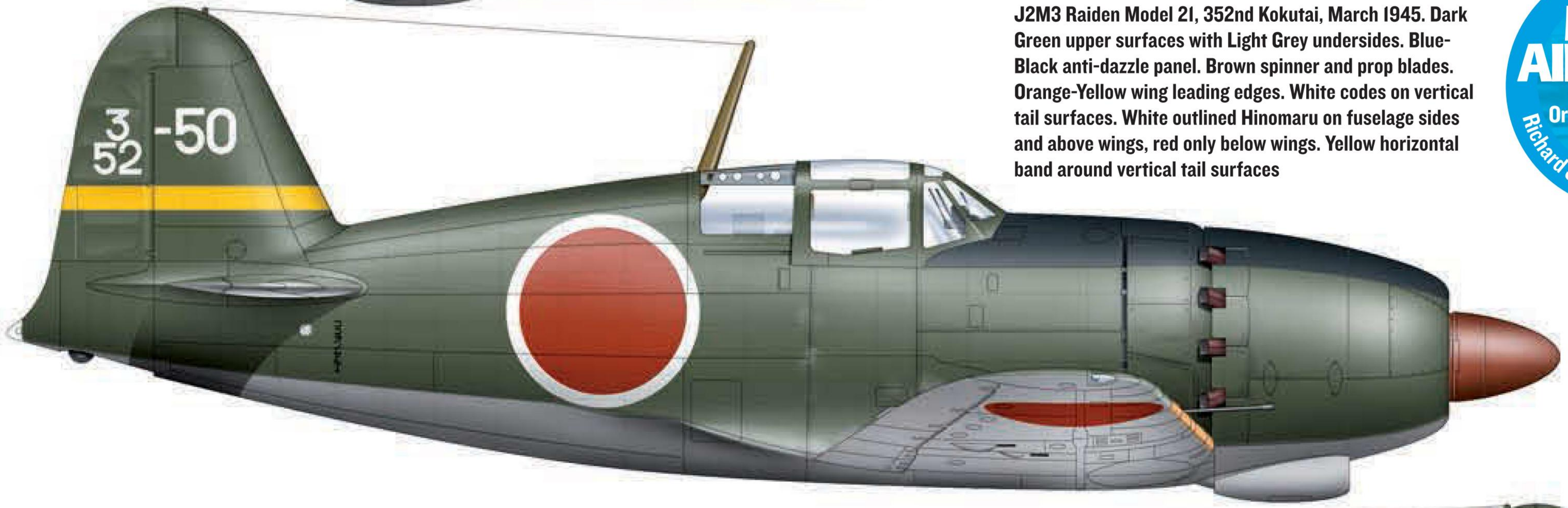
J2M3 Raiden, Model 21, Genzan Kokutai, Kagoshima, late 1944.. Dark Green upper surfaces with Light Grey undersides. Blue-Black anti-dazzle panel. Orange-Yellow wing leading edges. Yellow codes on vertical tail surfaces and spinner front. White outlined Hinomaru on fuselage sides and above wings, red only below wings



J2M3 Raiden Model 21, 302nd Kokutai, Atsugi, Early 1945.. Dark Green upper surfaces with Light Grey undersides. Blue-Black anti-dazzle panel. Brown spinner and prop blades. Orange-Yellow wing leading edges. White codes. White outlined Hinomaru on fuselage sides and above wings, red only below wings



J2M3 Raiden Model 21, 352nd Kokutai, March 1945. Dark Green upper surfaces with Light Grey undersides. Blue-Black anti-dazzle panel. Brown spinner and prop blades. Orange-Yellow wing leading edges. White codes on vertical tail surfaces. White outlined Hinomaru on fuselage sides and above wings, red only below wings. Yellow horizontal band around vertical tail surfaces



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J2M3 Raiden Model 21, flown by Lt J.G. Yorshihiro Aoki of 352nd Kokutai, 1945. Dark Green upper surfaces with Light Grey undersides. Blue-Black anti-dazzle panel. Brown spinner and prop blades. Orange-Yellow wing leading edges. White codes on vertical tail surfaces. White outlined Hinomaru on fuselage sides and above wings, red only below wings. Yellow flashes on fuselage sides with red drop shadow

Profiles 1:72 Scale
0 metres 1 2
0 feet 3 6

Republic P-47D-22-RE Thunderbolt, 42-26387/MX-W, 'Miss Behave', 82nd FS, 78th FG, 8th AF, Duxford. Olive Drab/Neutral Grey scheme with red rudder and white bands around fin/rudder and horizontal tail surfaces. Black/white checks on engine cowling. National markings below both wings

Republic P-47D-15-RE Thunderbolt, 42-275855WW/5F-A, 5th Emergency Rescue Squadron, 8th AF, RAF Boxted, summer 1944. Olive Drab/Neutral Grey scheme with black/white invasion stripes around fuselage and wings; Yellow band around vertical and horizontal tail surfaces, wingtips serial. Code is white, outlined in black; Insignia Red, White and Blue cowling bands. National markings in six positions; note the underwing markings overlapping over the invasion stripes and are positioned at an angle

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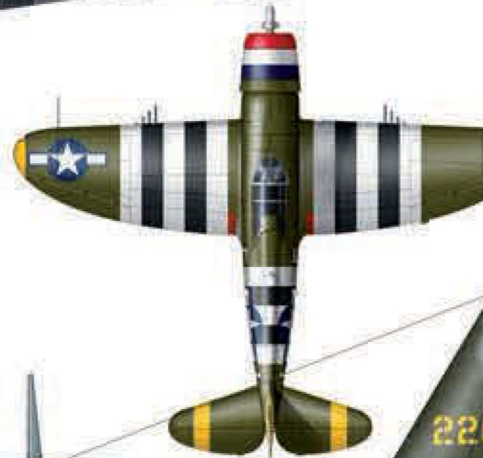
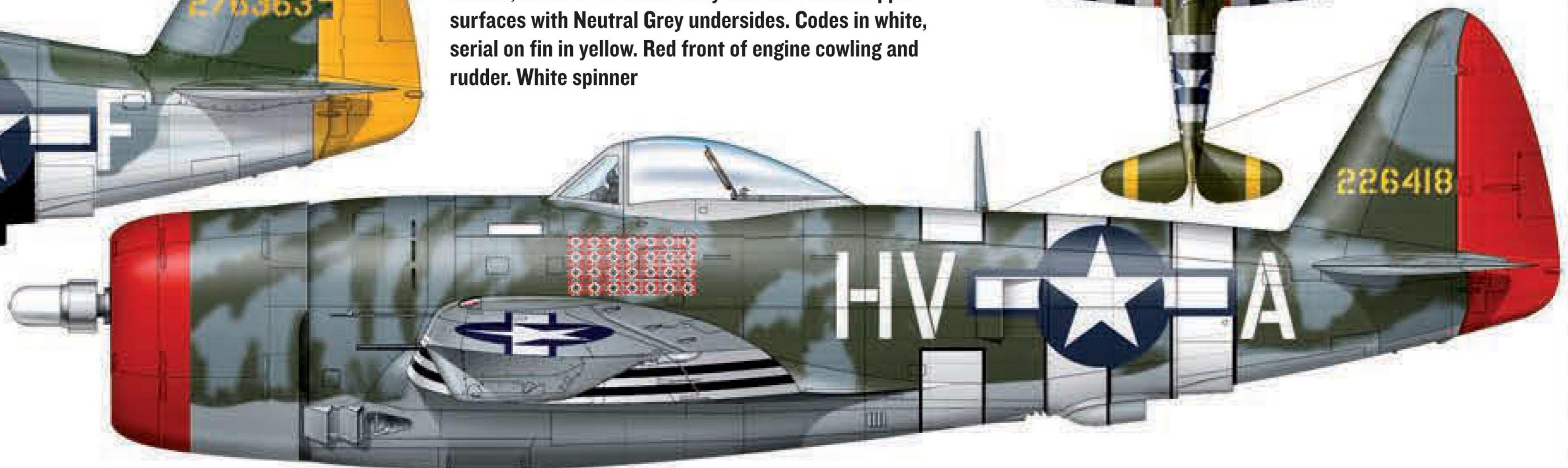
Republic P-47D-15-RE Thunderbolt, 42-76363/LM-F, 62nd FS, 56th FG, 8th AF, Boxted, summer 1944. Ocean Grey and Dark Green camouflage applied on upper surfaces of the natural metal surfaces; Yellow rudder and Red front of cowling. Codes in White while the serial is Yellow; Black/White stripes underneath rear fuselage only. National markings in six positionsrr

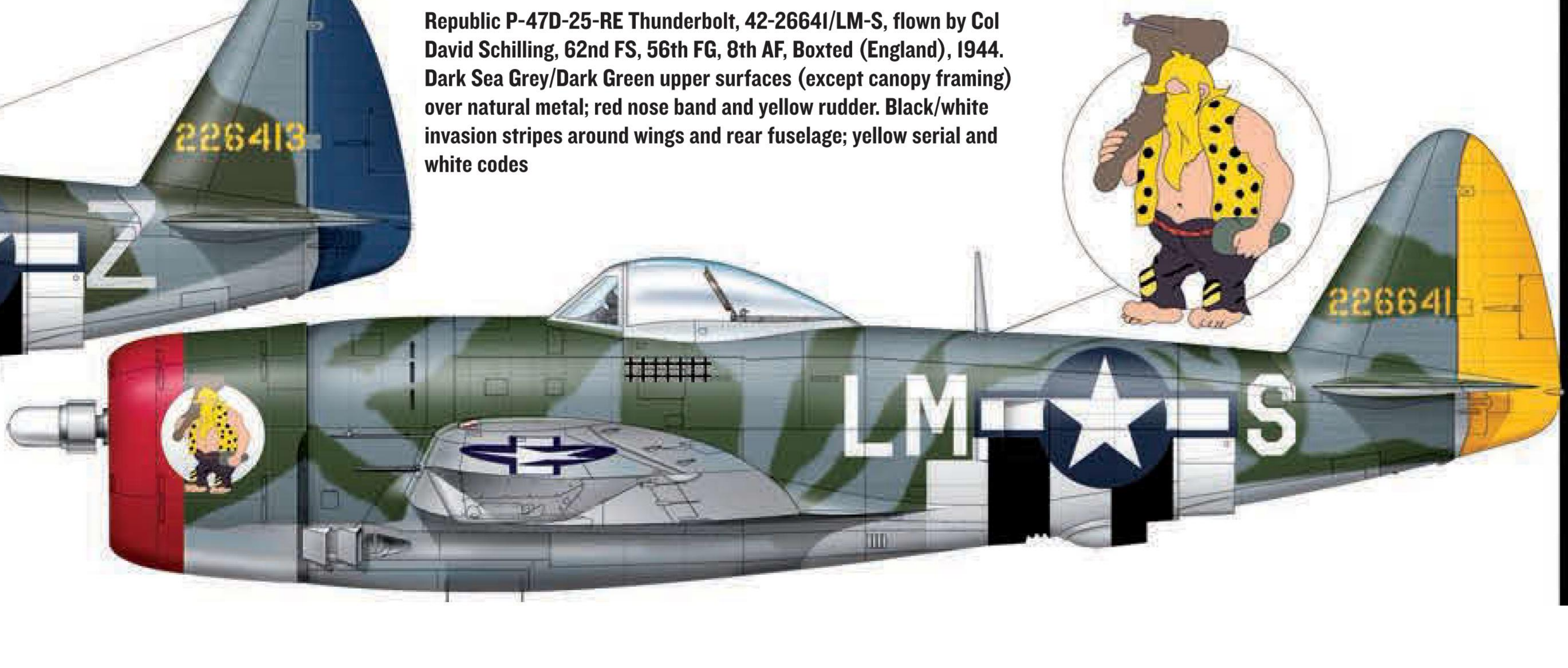


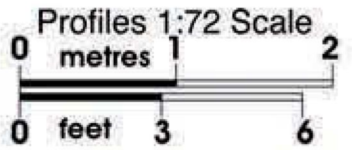
Republic P-47D-25-RE Thunderbolt, 42-26418/HV-A, flown by Col Francis Gabreski, 61st FS, 56th FG, 8th AF, Boxted, June 1944. Ocean Grey and Dark Green upper surfaces with Neutral Grey undersides. Codes in white, serial on fin in yellow. Red front of engine cowling and rudder. White spinner



Republic P-47D-25-RE Thunderbolt, 42-26413/Z, flown by Col Hubert Zemke, CO of the 56th FG, Boxted, summer1944. Originally natural metal overall with Olive Drab fuselage top deck, with top surfaces and fuselage sides overpainted in Ocean Grey and Dark Green. Red front of cowling; mid-blue rudder. Black/white stripes under rear fuselage only; national markings on fuselage sides, above port wing and underneath both wings. Code is white; serial and name 'Happy Warrior' in yellow. Note 'Oregons Britannia' in black aft of cockpit

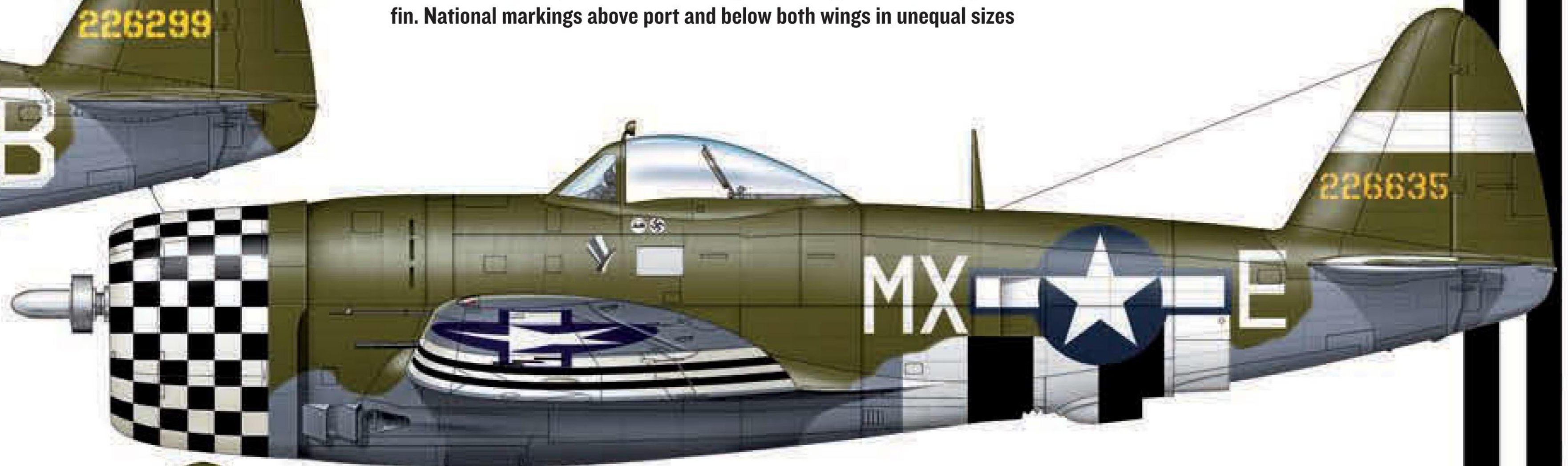
Republic P-47D-25-RE Thunderbolt, 42-26641/LM-S, flown by Col David Schilling, 62nd FS, 56th FG, 8th AF, Boxted (England), 1944. Dark Sea Grey/Dark Green upper surfaces (except canopy framing) over natural metal; red nose band and yellow rudder. Black/white invasion stripes around wings and rear fuselage; yellow serial and white codes



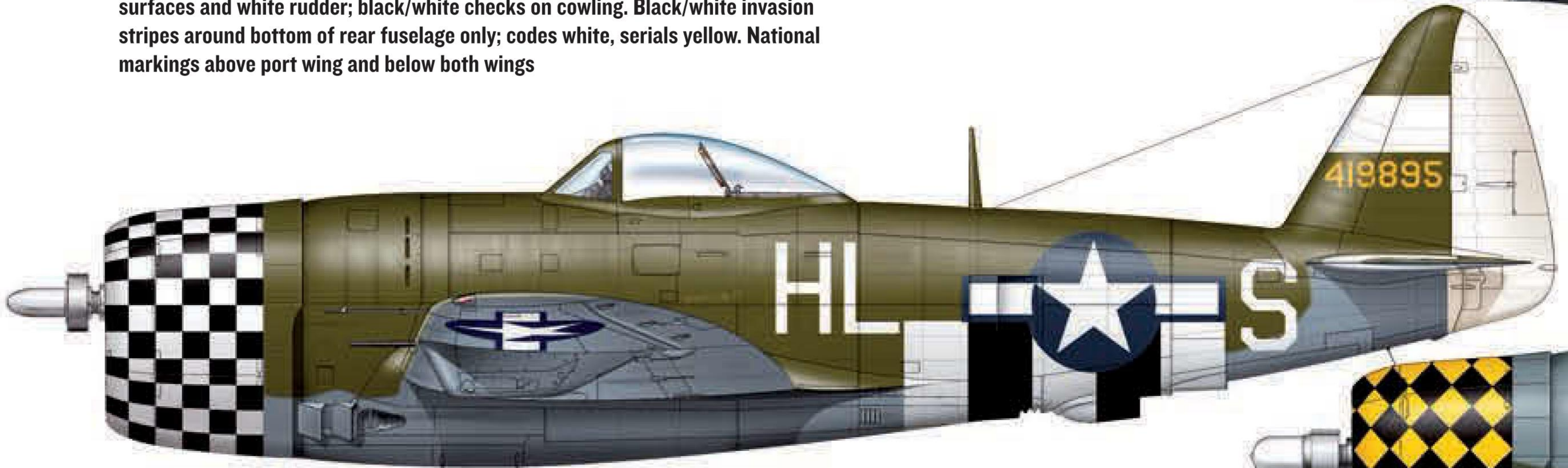


Republic P-47D-26-RA Thunderbolt, 42-262299/UN-B, flown by Capt Cameron Hart, 63rd FS, 56th FG, 8th AF USAAF, Boxted, autumn 1944. Olive Drab upper surfaces with Neutral Grey undersides. Red front of cowling. White codes, yellow serial. Four victory crosses and two swastikasbelow cockpit

Republic P-47D-25-RE Thunderbolt, 42-26635/MX-E, 82nd FS, 78th FG, 8th AF,summer 1944. Olive Drab/Neutral Grey finish with Black/White bands below rear fuselage, below wings, faded above wings. White bands across vertical and horizontal tail surfaces. Black/White checks on engine cowling. White codes, yellow serial on fin. National markings above port and below both wings in unequal sizes



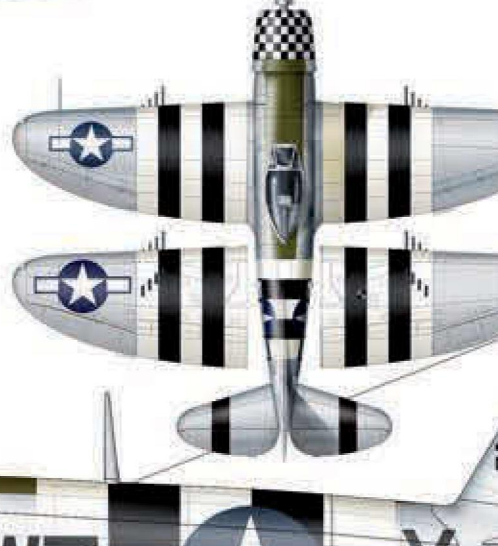
Republic P-47D-28-RE Thunderbolt, 44-19895/HL-S, 83rd FS, 78th FG, 8th AF, Duxford, 1944. Olive Drab/Neutral Grey scheme with white bands around tail surfaces and white rudder; black/white checks on cowling. Black/white invasion stripes around bottom of rear fuselage only; codes white, serials yellow. National markings above port wing and below both wings

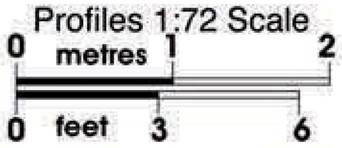


Republic P-47D-25-RE Thunderbolt, 42-26459/SX-B, flown by Lt Col William B. Bailey, 352nd FS, 353rd FG, 8th AF, Raydon, July 1944. Ocean Grey and Dark Green upper surfaces with natural metal undersides. Black/White bands around wings and below rear fuselage. Yellow/Black checks on cowling. White codes, black serial. National markings above port wing and below both wings

Republic P-47D-26-RE Thunderbolt, 42-28382/HV-S, 'Ole Cock III', flown by Capt Donovan Smith, 61st FS, 56th FG, 8th AF, Boxted, June 1944. Dark Sea Grey and Light Sea Grey upper surfaces with natural metal undersides (some sources quote Azure Blue for undersides, though unlikely). Red cowling front and rudder. Black/White bands around wings and below rear fuselage. Codes in black, outline in white, serial on fin in black. National markings above port wing and below both wings

Republic P-47D-25-RE Thunderbolt, 42-26640/WZ-X, flown by Lt Ross Orr. Dothan, 84th FS, 78th FG, 8th AF. Natural metal overall with Black/White cheacks on engine cowling. Black/White bands around wings and rear fuselage. Black bands around vertical and horizontal tail surfaces. Codes and serial in black

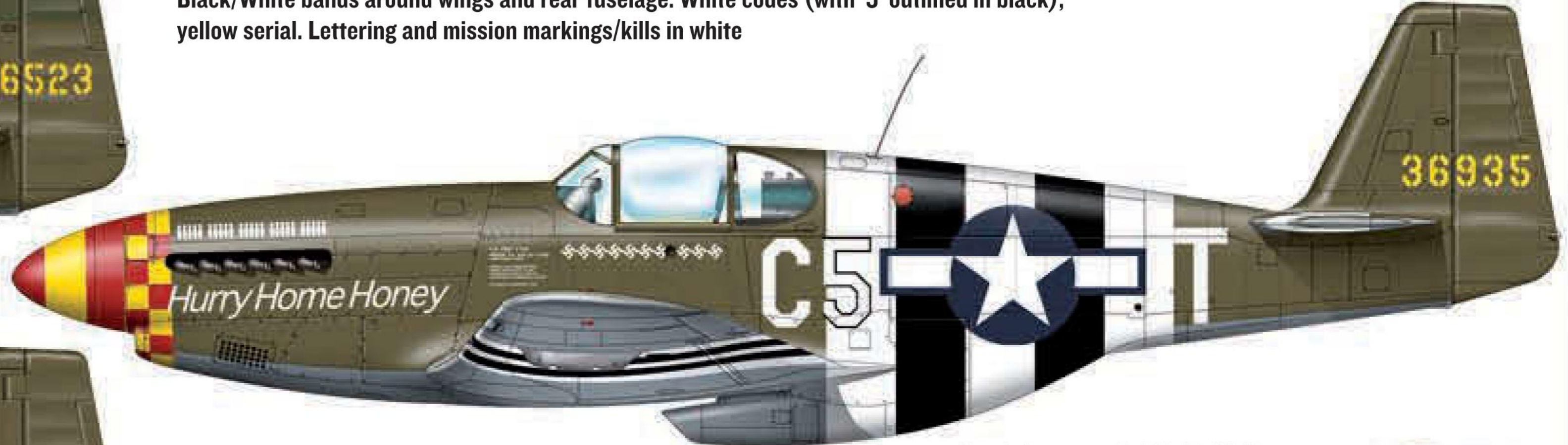




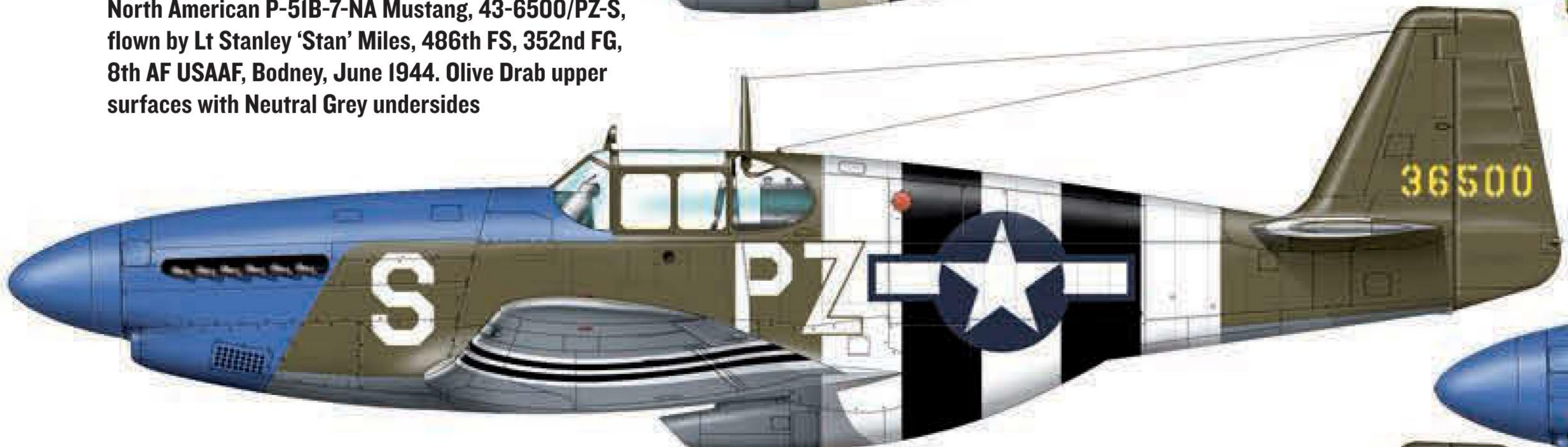
USAAF - OPERATION OVERLORD

North American P-51B Mustang, 43-6523/YF-E, 'Leaking Liz', flown by Lt Charles Blair, 358th FS, 355th FG, 8th AF USAAF, summer 1944. Olive Drab upper surfaces with Neutral Grey undersides.

North American P-51B-5-NA, 43-6935/C5-T, 'Hurry Home Honey', flown by Capt Richard Peterson, 364th FS, 357th FG, 8th AF, USAAF, May 1944. Olive Drab ANA 613/Sea Grey ANA 603 upper surfaces with Light Grey ANA 602 undersides Yellow/Red checks and bands around nose. Black/White bands around wings and rear fuselage. White codes (with '5' outlined in black), yellow serial. Lettering and mission markings/kills in white

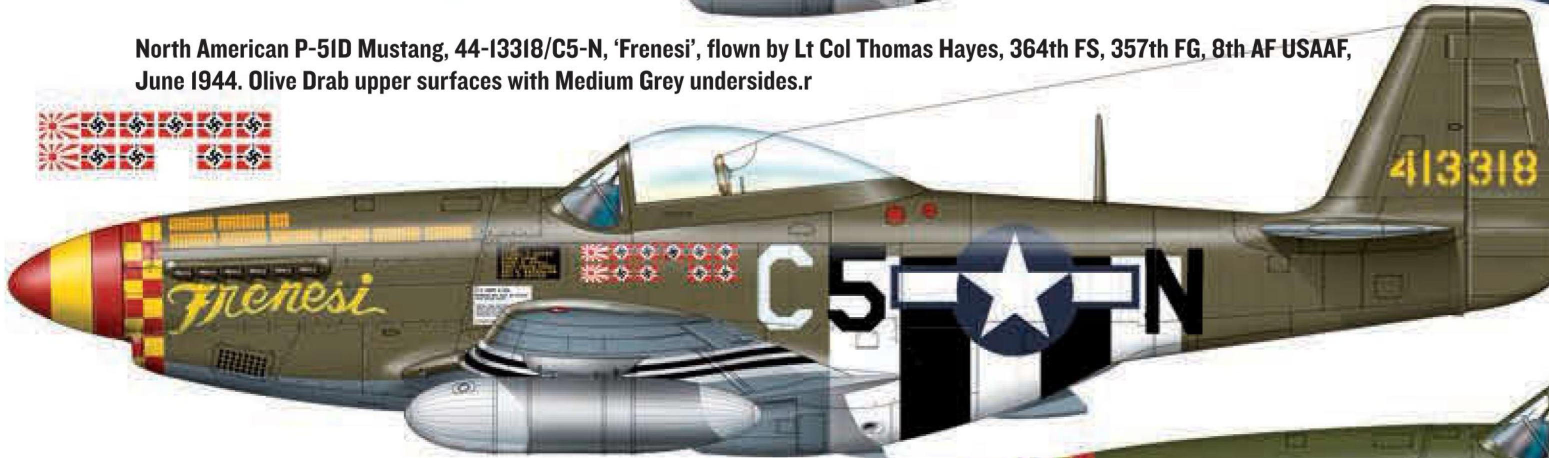


North American P-51B-7-NA Mustang, 43-6500/PZ-S, flown by Lt Stanley 'Stan' Miles, 486th FS, 352nd FG, 8th AF USAAF, Bodney, June 1944. Olive Drab upper surfaces with Neutral Grey undersides



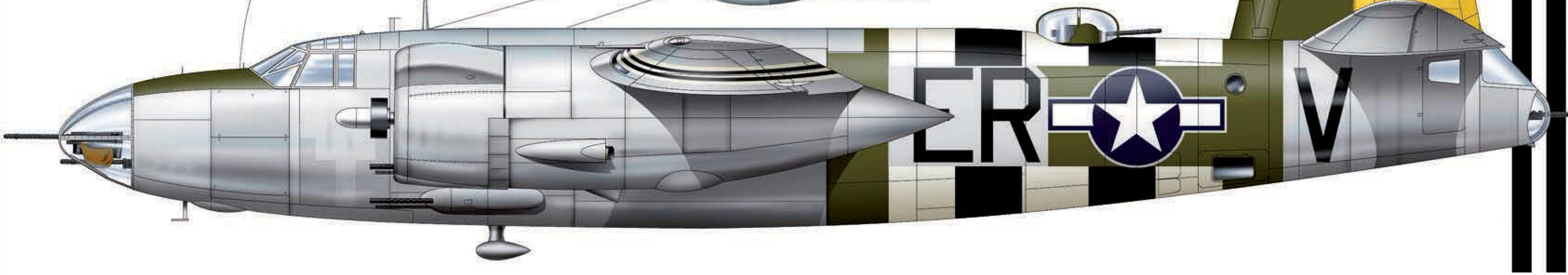
North American P-51B-15-NA Mustang, 42-106872/PE-T (bar), flown by 1st Lt John F. Thornell Jr, 328th FS, 352nd Fighter Group, Bodney, July 1944

North American P-51D Mustang, 44-13318/C5-N, 'Frenesi', flown by Lt Col Thomas Hayes, 364th FS, 357th FG, 8th AF USAAF, June 1944. Olive Drab upper surfaces with Medium Grey undersides.r

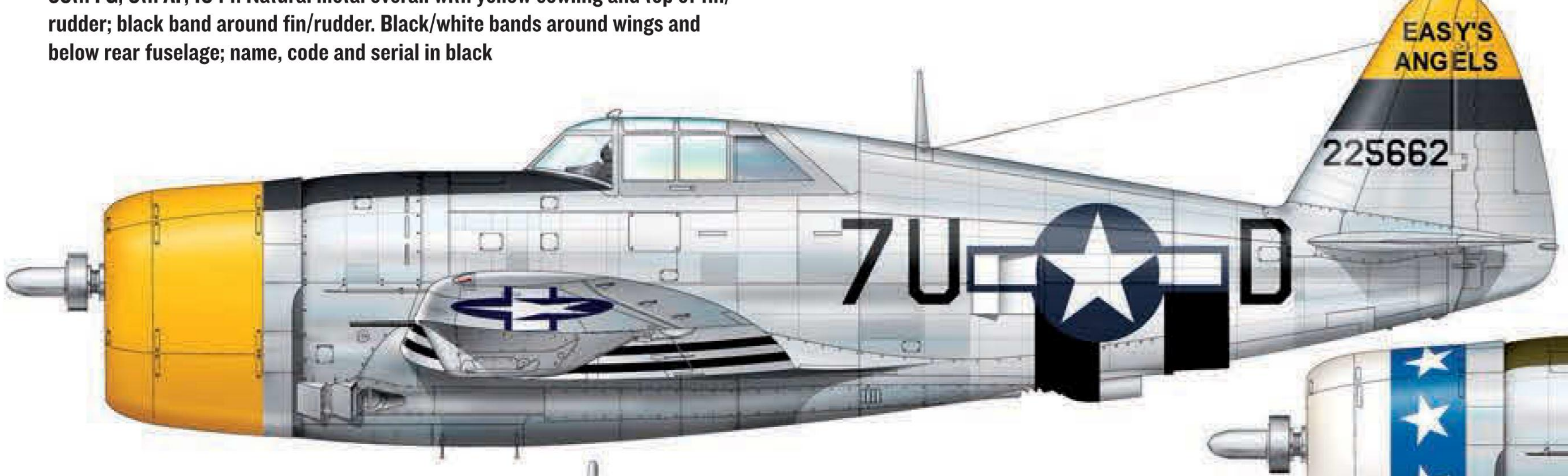


North American P-51D Mustang, 413334/G4-U, 'Wee WIlly', flown by Capt Harry Mace, 362nd FS, 357th FG, 8th AF. Natural metal overall except for the fuselage top decking, horizontal and vertical tail surfaces which are in Olive Drab. Yellow serial on fin, and yellow/red trim on nose. Note four victory markings beneath canopy

B-26C-45 Marauder, 42-107685/ER-V, 451st BS, 322nd BG, 9th Air Force, Great Saling, June 1944. Natural metal overall with Olive Drab rear fuselage section, fin and anti-dazzle panels (ahead of cockpit and inside faces of engine colwings); codes in black. White/Black stripes around rear fuselage and wings; national markings in standard positions. Yellow rudder and serial on fin; black serial on rudderr

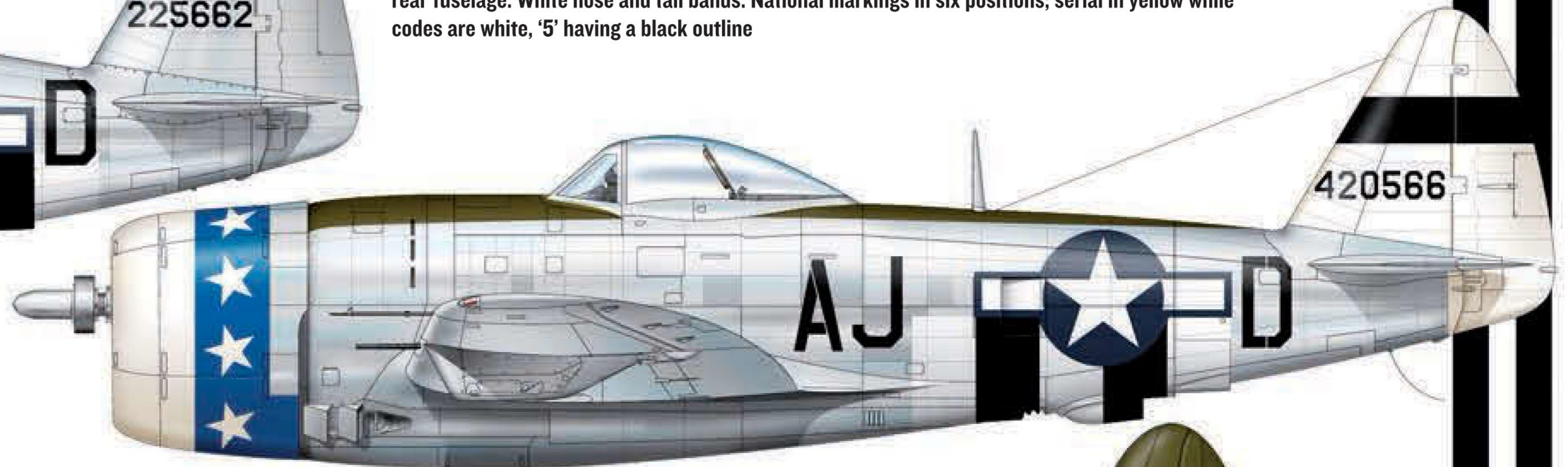


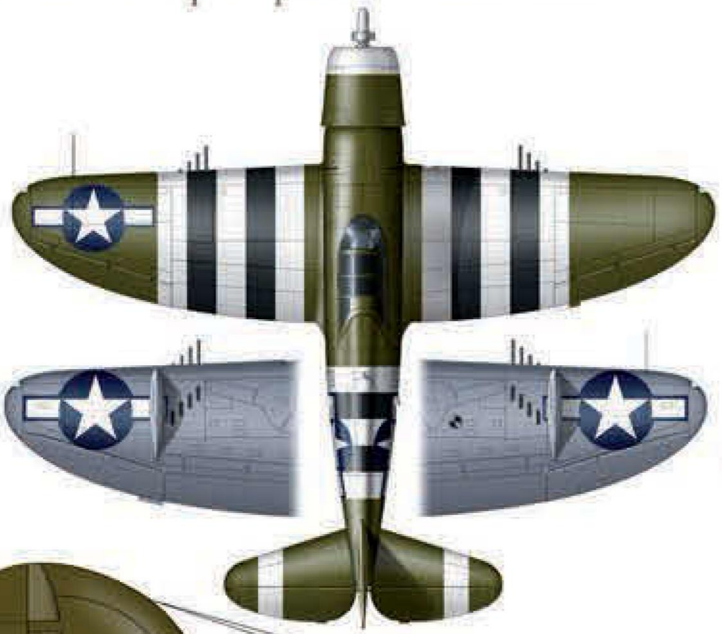
Republic P-47D-22-RA Thunderbolt, 42-25662/7U-D, 'Easy's Angels', 23rd FS, 36th FG, 9th AF, 1944. Natural metal overall with yellow cowling and top of fin/rudder; black band around fin/rudder. Black/white bands around wings and below rear fuselage; name, code and serial in black



Below: Republic P-47D-30-RE Thudnerbolt, 44-20566, AJ-D, 356th FS, 354th FG, 9th AF, 1944. Natural metal overall with Olive drab anti-dazzle panel; white front of cowling and fin/rudder. Mid-Blue band around cowling with white stars; black band around fin/rudder, serials and codes

Below (third from top): Republic P-47D-1-RA Thunderbolt, 42-7895/D5-H, 386th FS, 365th FG, 9th AF. Olive Drab upper surfaces with Neutral Grey undersides. Black/White bands around wings and rear fuselage. White nose and tail bands. National markings in six positions; serial in yellow while codes are white, '5' having a black outline





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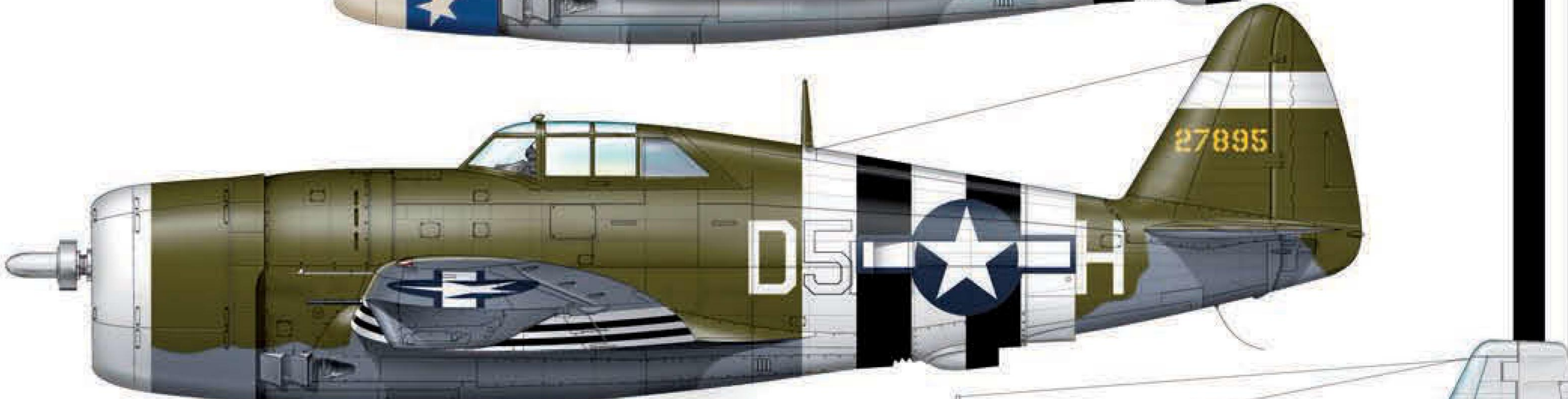
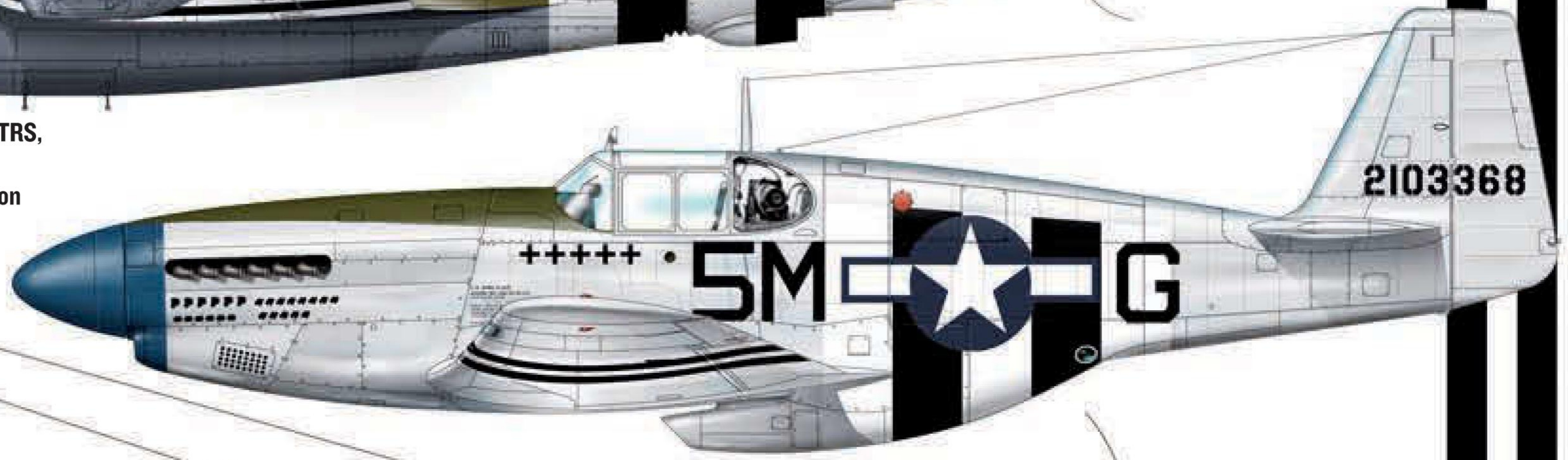
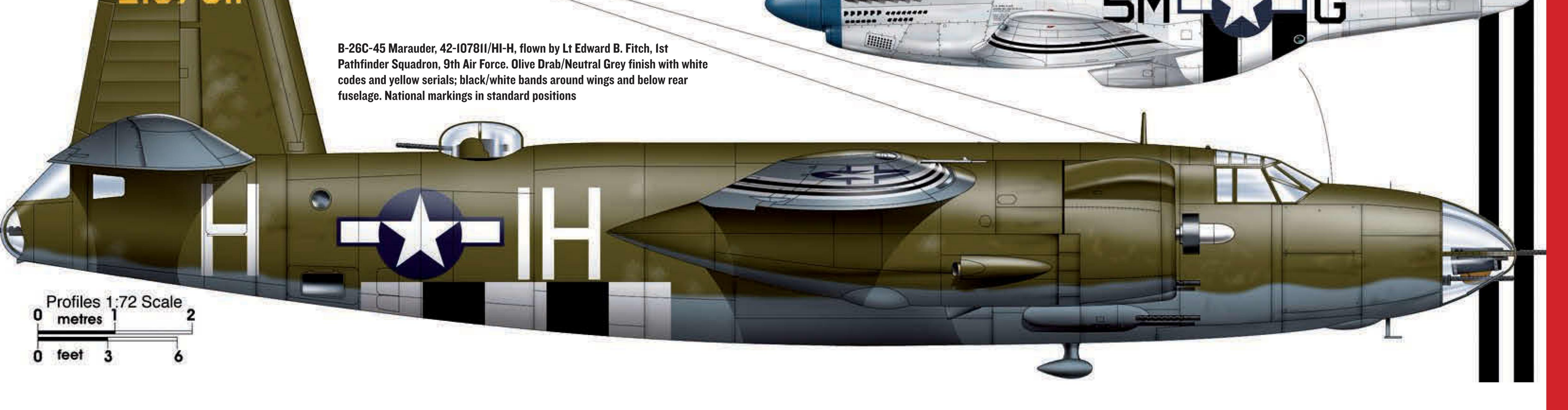


North American F-6CNT (P-51C-5-NT), 42-103368/5M-G, flown by Capt John Hoefker, 15th TRS, 10th PRG, 9th AF USAAF, June 1944. Natural metal overall with Olive Drab anti-dazzle panel. Blue nose. Black/White bands around wings and rear fuselage. Black codes and serial. Mission markings (cameras and binoculars) in black, five victory markings below windscreen

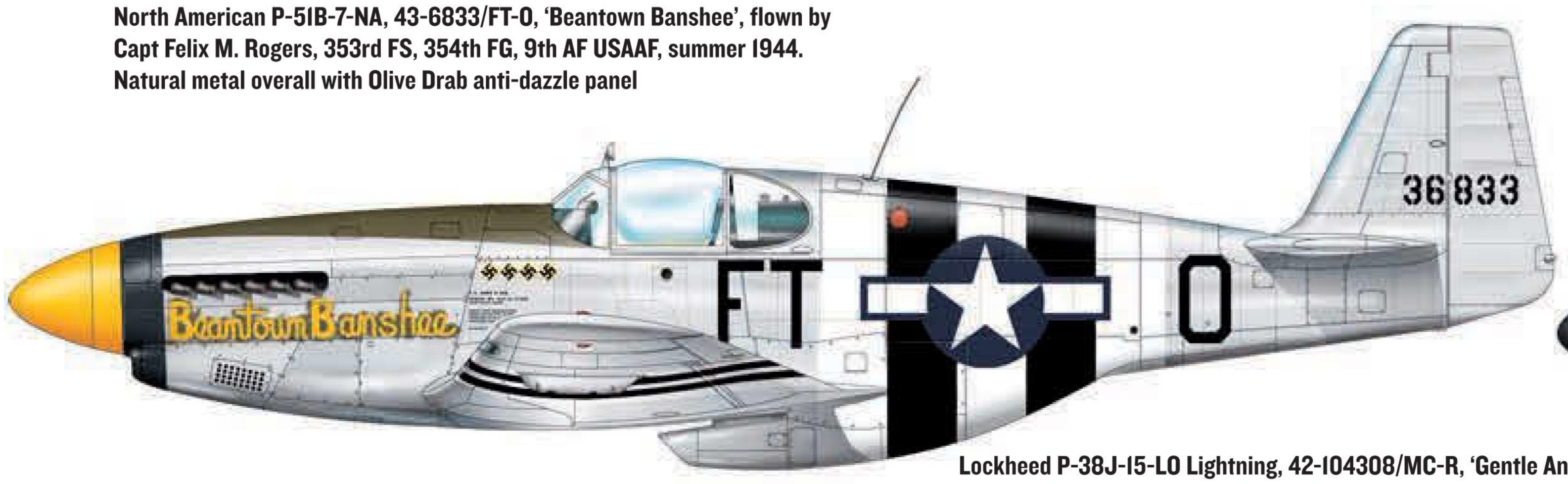


B-26C-45 Marauder, 42-107811/HI-H, flown by Lt Edward B. Fitch, 1st Pathfinder Squadron, 9th Air Force. Olive Drab/Neutral Grey finish with white codes and yellow serials; black/white bands around wings and below rear fuselage. National markings in standard positions



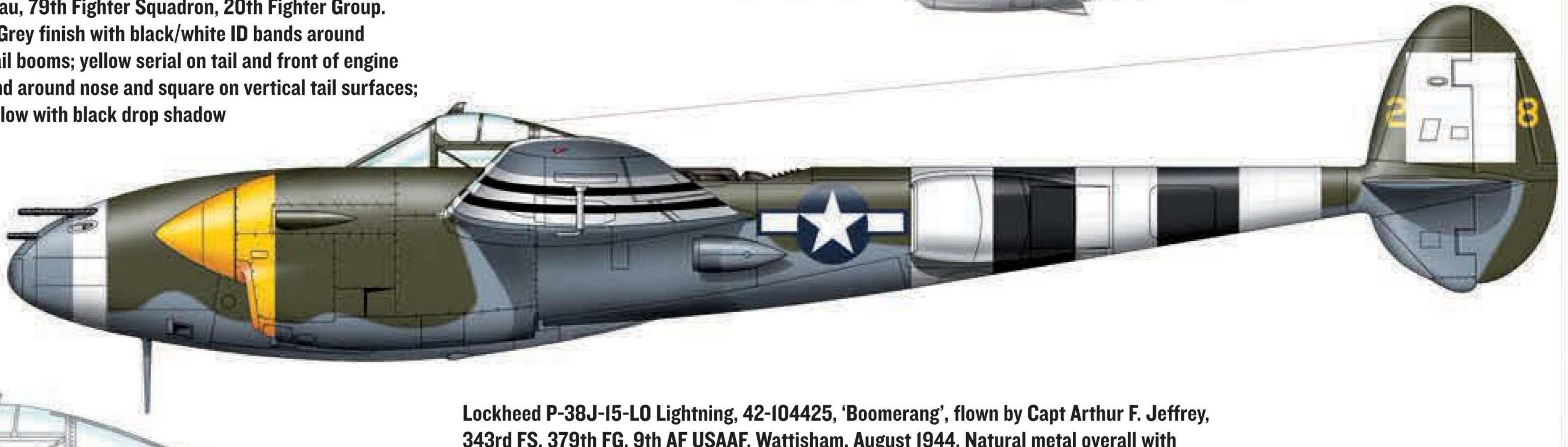
USAAF - OPERATION OVERLORD

North American P-51B-7-NA, 43-6833/FT-O, 'Beantown Banshee', flown by Capt Felix M. Rogers, 353rd FS, 354th FG, 9th AF USAAF, summer 1944. Natural metal overall with Olive Drab anti-dazzle panel

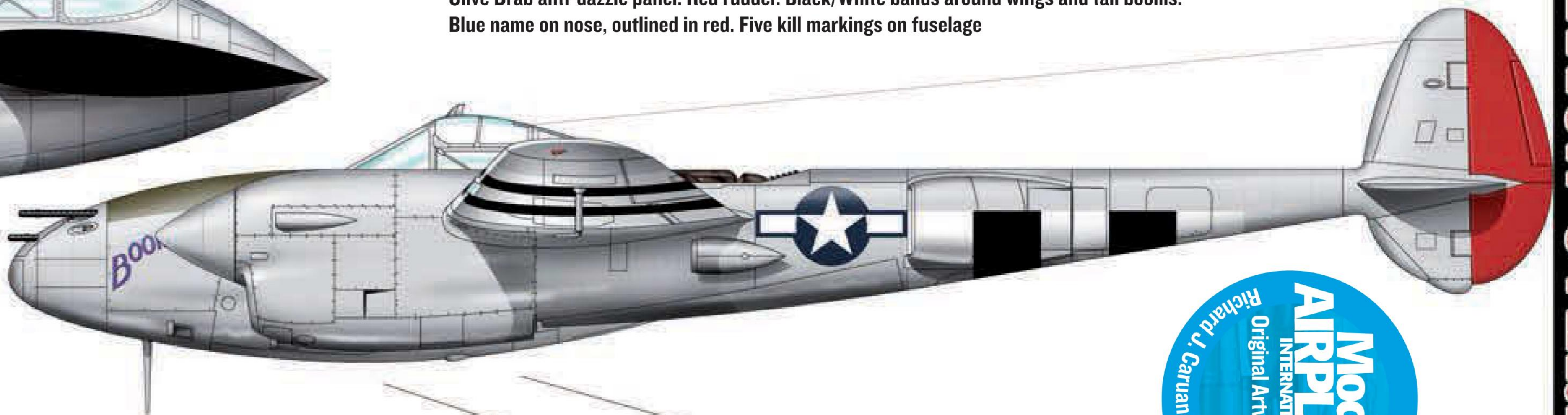


North American P-51D-5-NA, 44-13380/C3-M, 'Hoo Flung Dung', flown by Maj Robert McWherter, 382nd FS, 363rd FG, 9th AF USAAF, 1944. Natural metal overall with Olive Drab anti-dazzle panel. Black nose and spinner, black codes and serial. Black/White bands around wings and rear fuselage. Name in red with 'City of Paris' on starboard sider

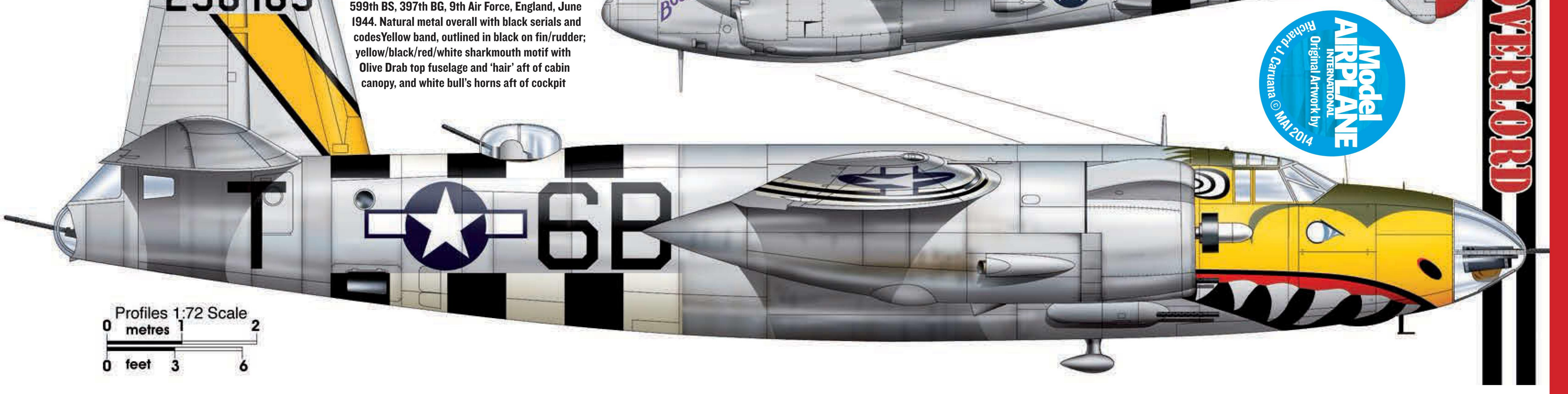
Lockheed P-38J-15-LO Lightning, 42-104308/MC-R, 'Gentle Annie', flown by Col. H.J. Rau, 79th Fighter Squadron, 20th Fighter Group. Olive Drab/Neutral Grey finish with black/white ID bands around wings and rear of tail booms; yellow serial on tail and front of engine cowlings. White band around nose and square on vertical tail surfaces; nose lettering in yellow with black drop shadow



Lockheed P-38J-15-LO Lightning, 42-104425, 'Boomerang', flown by Capt Arthur F. Jeffrey, 343rd FS, 379th FG, 9th AF USAAF, Wattisham, August 1944. Natural metal overall with Olive Drab anti-dazzle panel. Red rudder. Black/White bands around wings and tail booms. Blue name on nose, outlined in red. Five kill markings on fuselage



B-26B-55, 42-96165/6B-T, 'The Big, Hairy Bird', 599th BS, 397th BG, 9th Air Force, England, June 1944. Natural metal overall with black serials and codesYellow band, outlined in black on fin/rudder; yellow/black/red/white sharkmouth motif with Olive Drab top fuselage and 'hair' aft of cabin canopy, and white bull's horns aft of cockpit



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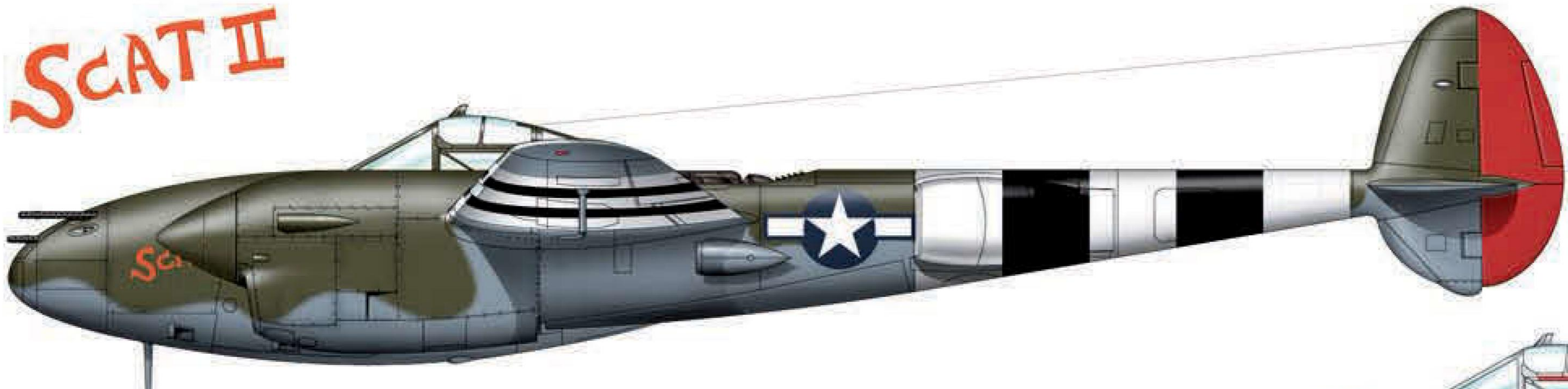
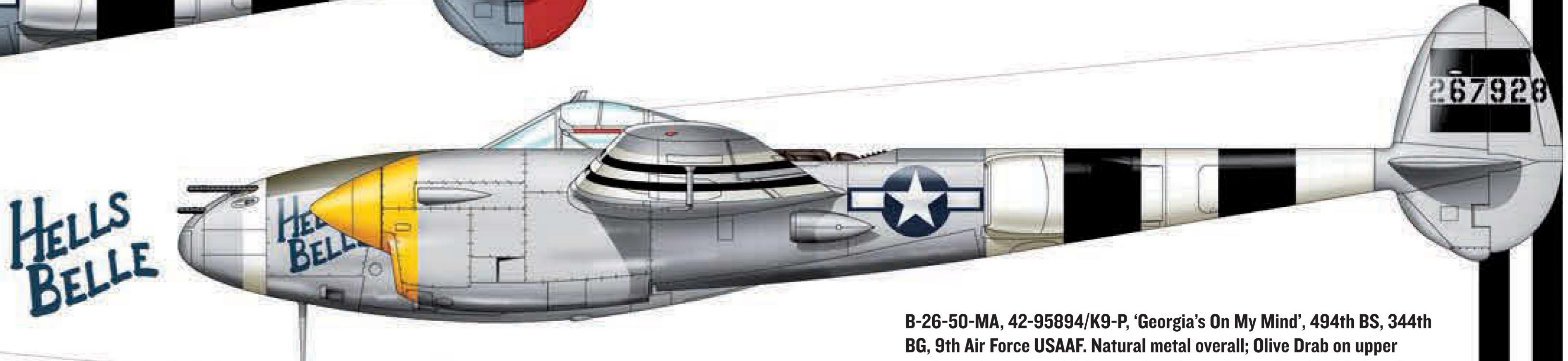




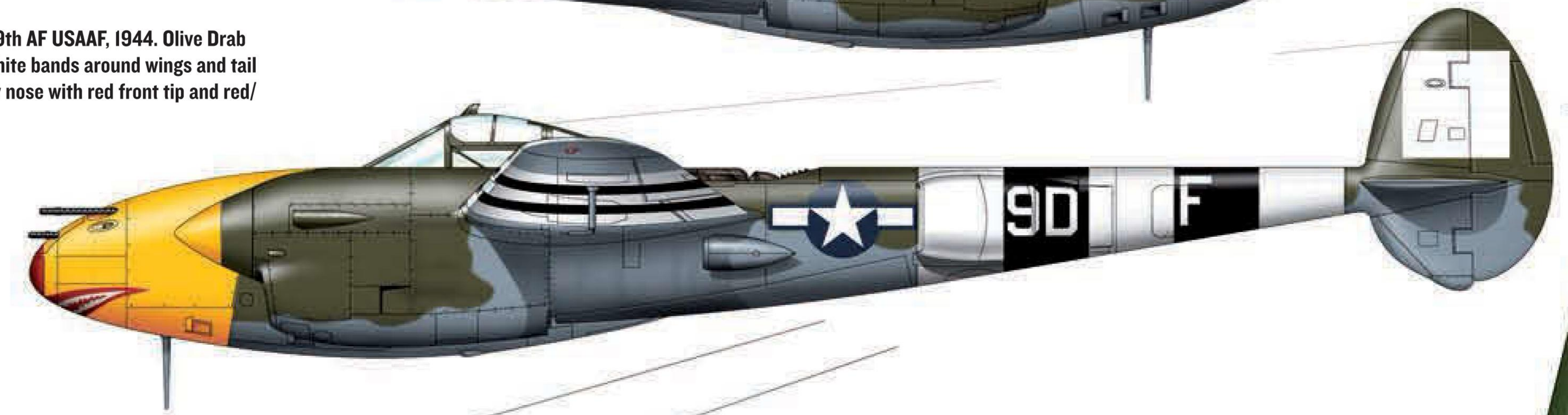
Left: Lockheed P-38J-15-LO Lightning, 43-28341, 'Scat II', flown by Capt Robin Olds, 434th FS, 479th FG, 9th AF USAAF, August 1944. Olive Drab upper surfaces with Neutral Grey undersides. Red rudder. Black/White bands around wings and tail booms. name on nose

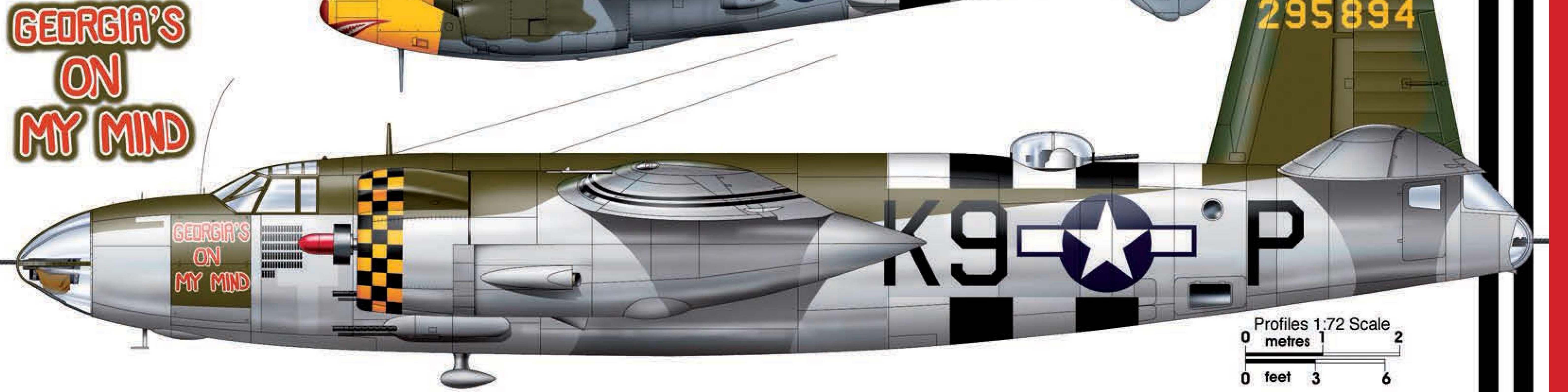
Below: Lockheed P-38J-10-LO Lightning, 42-67928/MC-L, 'Hells Belle', flown by 1st Lt Willard H. Lewis, 79th FS, 20th FG, 9th AF USAAF, 1944. Natural metal overall with Olive drab anti-dazzle panel. White band around nose, yellow spinners and front of engine cowlings. Black/White bands around wings and tail booms. Black bars over black serial on fin and rudder. Name in dark blue on nose

Lockheed P-38J-10-LO Lightning, 42-67799/7Y-P, 474th FS, 428th FG, 9th AF USAAF. Olive Drab/Neutral Grey finish with white triangle on outside face of tail; yellow serial (under white triangle) with '799' repeated on nose. Black/white stripes under tail booms; white codes. Standard national markings; 'P' of code repeated in white on inside faces of fin/rudder

B-26-50-MA, 42-95894/K9-P, 'Georgia's On My Mind', 494th BS, 344th BG, 9th Air Force USAAF. Natural metal overall; Olive Drab on upper surfaces of wings and tailplane, fuselage spine and vertical tail surfaces with Medium Green blotches applied to edges of flying surfaces. Code in black, serial in yellow; white triangle on vertical tail surfaces. Aircraft name in red, outlined in white, on an Olive Drab patch on port side only; misison markings in black. On two different photos the aircraft displays yellow/black checks on front of port cowling and none on starboardr

Lockheed P-38J Lightning, 9D-F, 435th FS, 370th FG, 9th AF USAAF, 1944. Olive Drab upper surfaces with Neutral Grey undersides. Black/White bands around wings and tail booms. White square on fin/rudder, white codes. Yellow nose with red front tip and red/white 'sharkmouth' motif





Douglas A-20J Havoc, 43-9913/8U-A, Squadron Commander's aircraft, 646th BS, 410th BG,9th AF USAAF, June 1944. Olive Drab and Neutral Grey, with black/white D-Day stripes around rear fuselage and wings. Serial is yellow while codes are white

Below: Douglas A-20G Havoc, 43-9224/5H-E, 'La France Libre', 66th BS, 416th BG, 9th AF, USAAF, France, autumn 1944. Olive Drab/Neutral Grey, with white rear section of rudder. Note flags on nose have a black outline. Its name evokes its record of being the first Havoc to achieve 100 missions over occupied Europe

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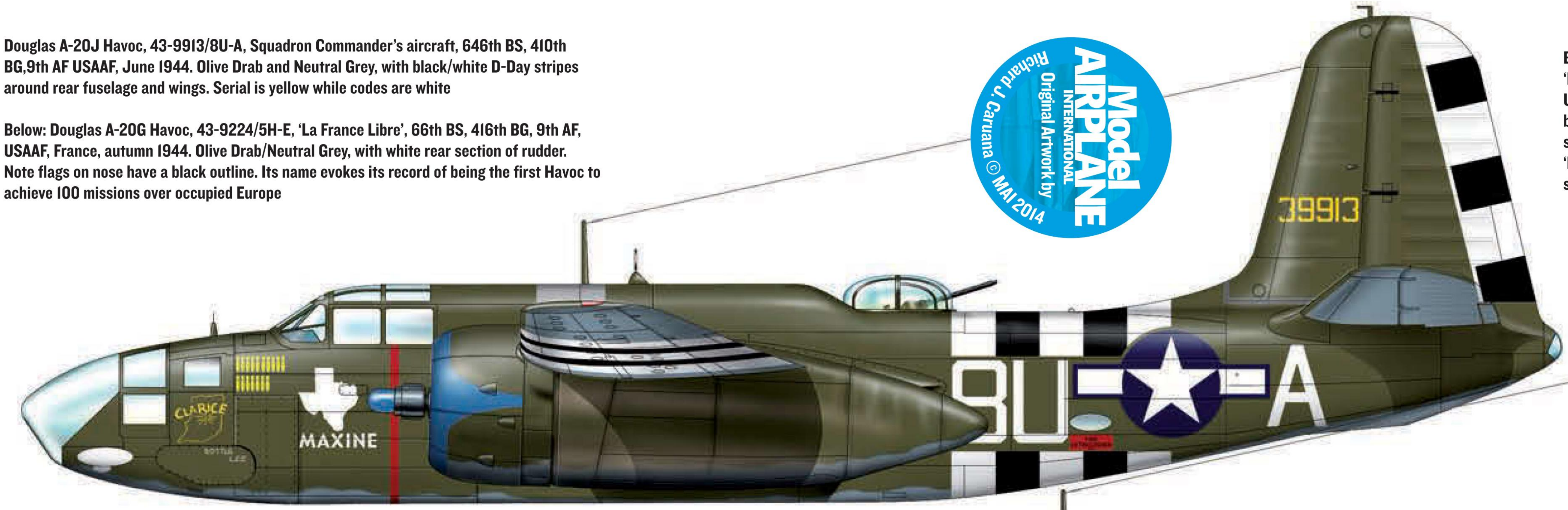
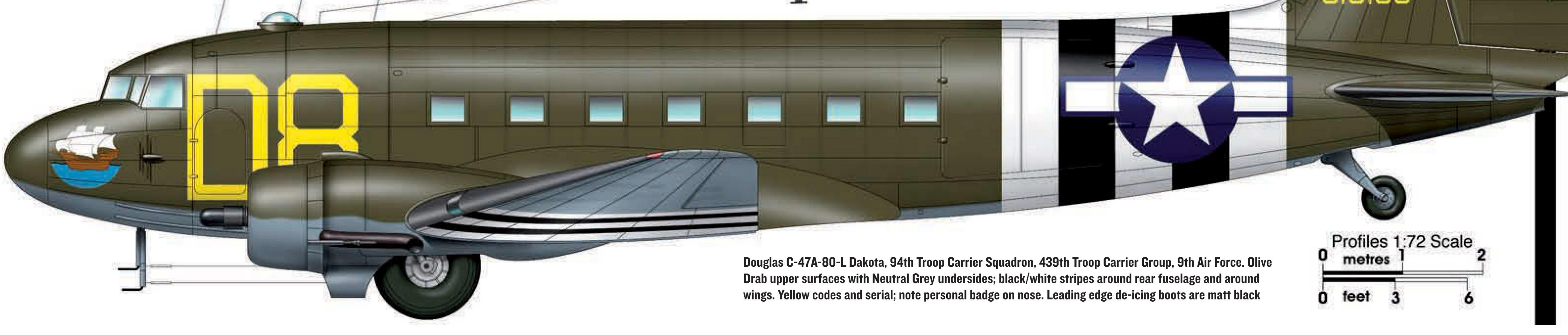
Below: Northrop P-61A-10-NO Black Widow, 42-5573 'Lovely Lady', 422nd Night Fighter Squadron, 9th AF USAAF, July 1944. Jet Black overall with white D-Day bands around wings and below rear of tail booms; red serials. Nose art in red and white, together with white 'Doris' on port engine cowling; nationalmarkings in standard positions





Profiles 1:72 Scale
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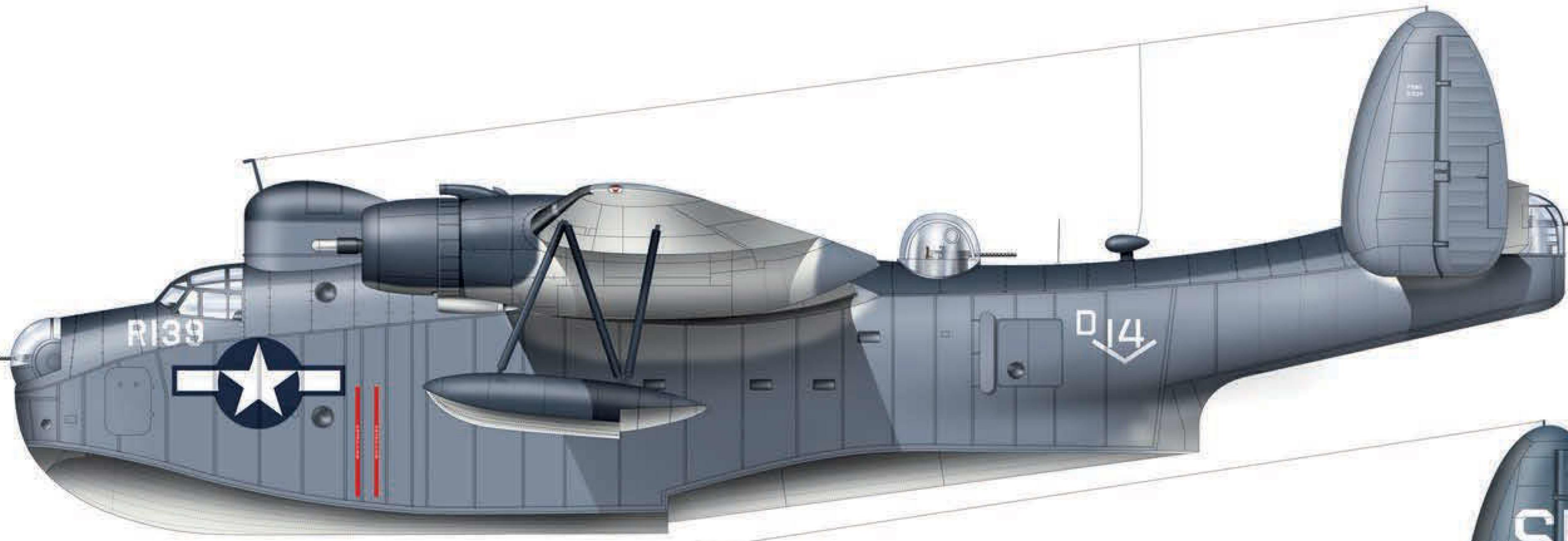
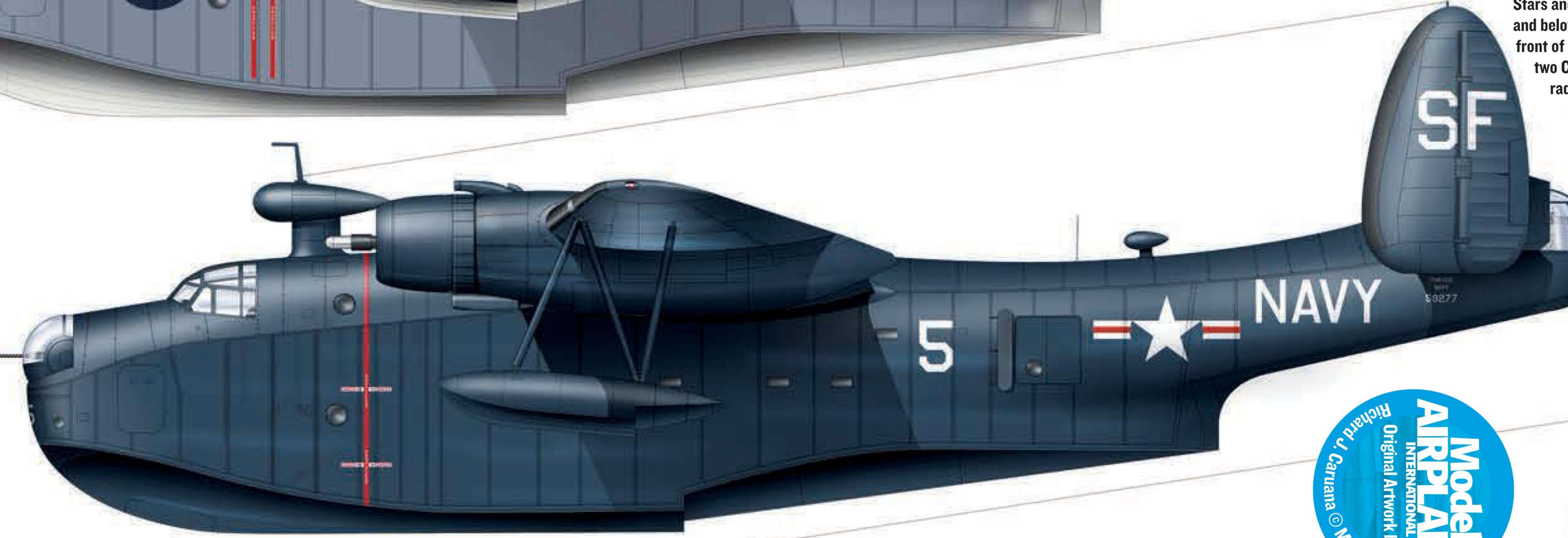
0 feet 3 6

Douglas C-47A-80-L Dakota, 94th Troop Carrier Squadron, 439th Troop Carrier Group, 9th Air Force. Olive Drab upper surfaces with Neutral Grey undersides; black/white stripes around rear fuselage and around wings. Yellow codes and serial; note personal badge on nose. Leading edge de-icing boots are matt black



Martin PBM-5 Mariner, BuNo.59139, 14-D, VPB-21 (tended by USS Chandeleur AV-10), Crew 14 captained by Lt John Drover, Okinawa (Japan). Top of wings and tailplane in Semi Gloss Sea Blue (ANA 606); fuselage sides in Non Specular Sea Blue (ANA 607) and Intermediate Blue (ANA 608) with undersides in Insignia White (ANA 601). Undersides of wings Insignia White ; undersides of tailpane Insignia White. All lettering in white. Stars and Bars on forward fuselage, above port and below starboard wings



Martin PBM-5S2 Mariner, BuNo.59277, SF-5, VP-731, 'Fox Blue', Fukuoka (Japan), 1952. Sea Blue Gloss overall with all lettering in white. Stars and Bars on fuselage sides, above port and below starboard wings. '5' repeated on front of nose. 'Crew 11' survived an attack by two Chinese MiG-15s whilst on a Fox Blue radar monitoring mission over Yellow Sea, 80 miles from Port Arthur, on 31 July 1952

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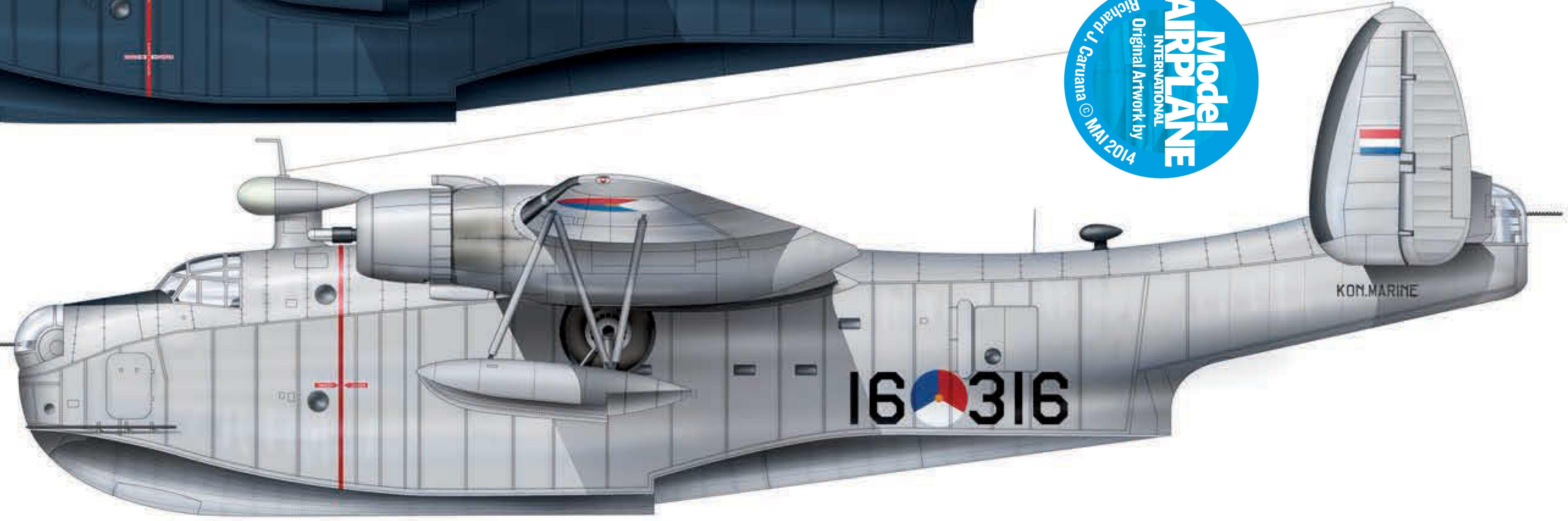
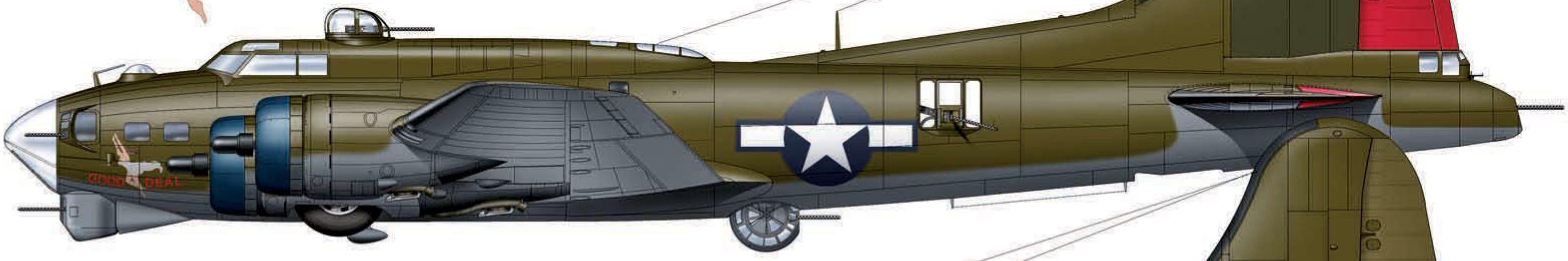
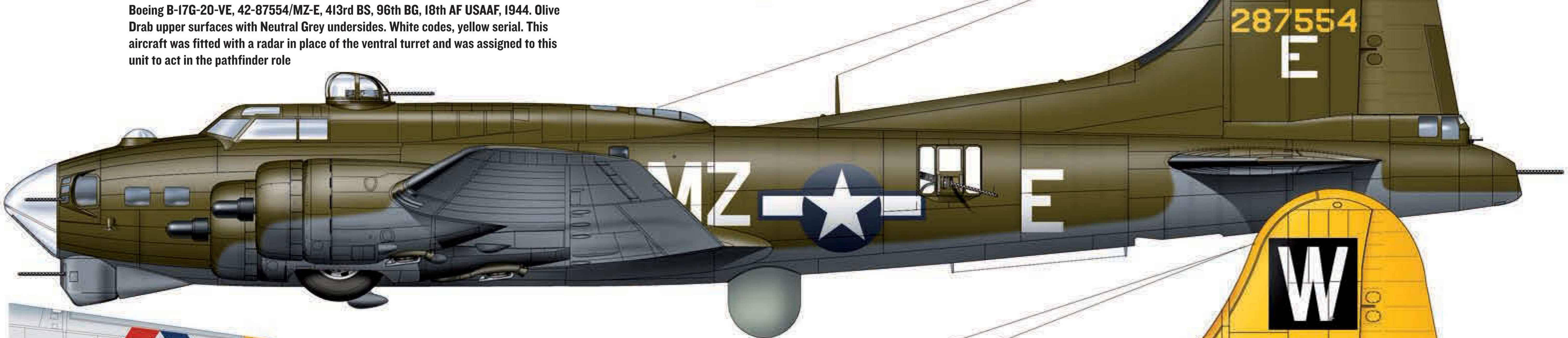


Martin PBM-5A Mariner (BuNo.122086) P-316, VSQ 321, Royal Netherlands Naval Air Service, Dutch New Guinea, 1955. Aluminium overall with black anti-dazzle panel. Roundels in six positions. All lettering in black



Boeing B-17G-35-BO, 42-32044, 'Good Deal', 815th BS, 483rd BG, 15th AF, USAAF, Tortorella (Italy), early 1945. Olive Drab upper surfaces with Neutral Grey undersides. Blue front of engine cowlings. White 'Y' and star on fin; yellow serial. Red rudder and elevators. This aircraft was the last camouflaged B-17 to leave the Seattle factory, after which all production aircraft remained in natural metal finish



Boeing B-17G-20-VE, 42-87554/MZ-E, 413rd BS, 96th BG, 18th AF USAAF, 1944. Olive Drab upper surfaces with Neutral Grey undersides. White codes, yellow serial. This aircraft was fitted with a radar in place of the ventral turret and was assigned to this unit to act in the pathfinder role

Boeing B-17G-60-DL, 44-6616, 'The Short Arm', 833rd BS, 487th BG, 18th AF USAAF, England, late 1944. Natural metal overall with yellow vertical and horizontal tail surfaces, wingtips and three bands around the rear fuselage. Green band around nose. Red/blue chevron above starboard wing. Lettering in black, excpet 'W' which is white over a black rectangle

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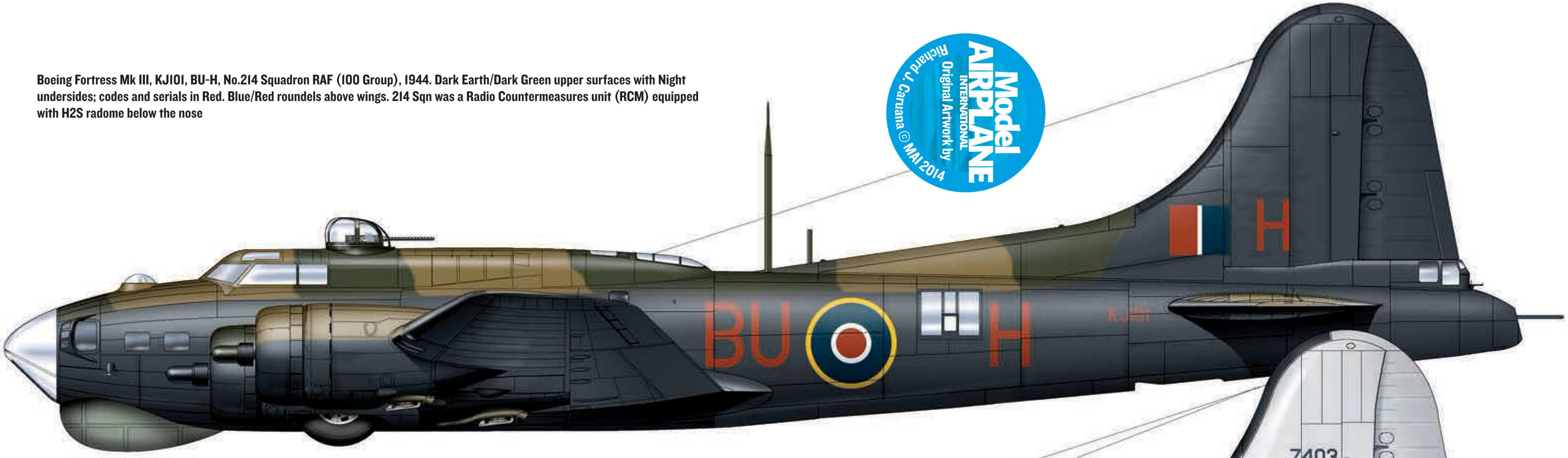
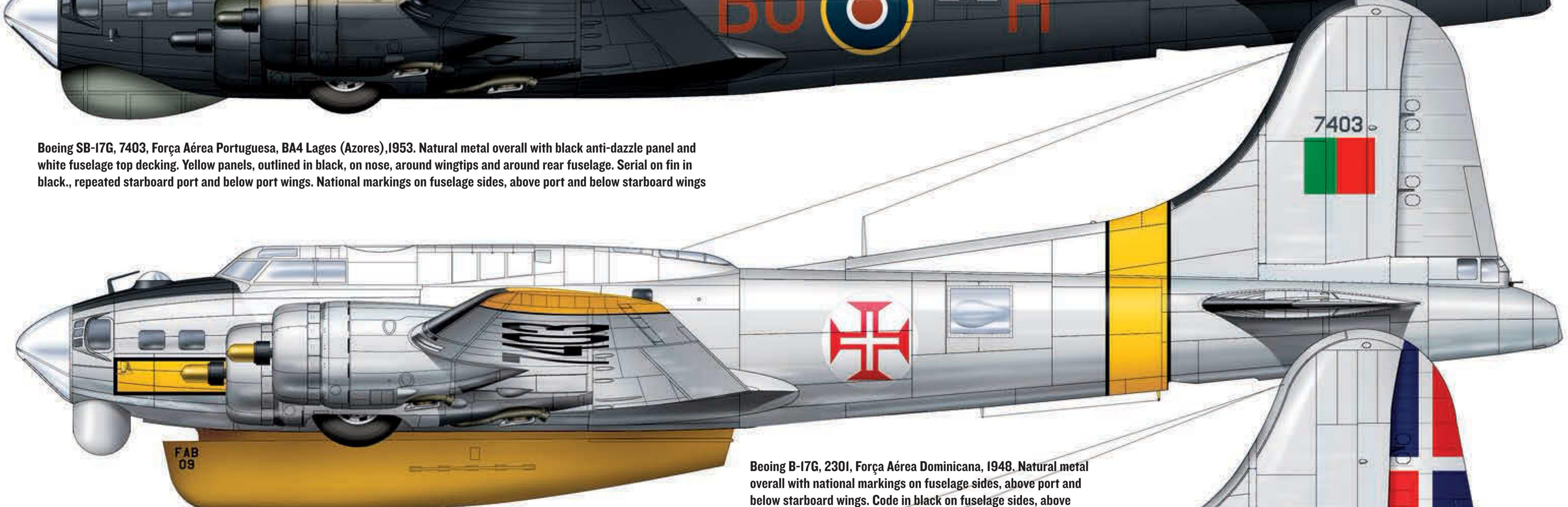
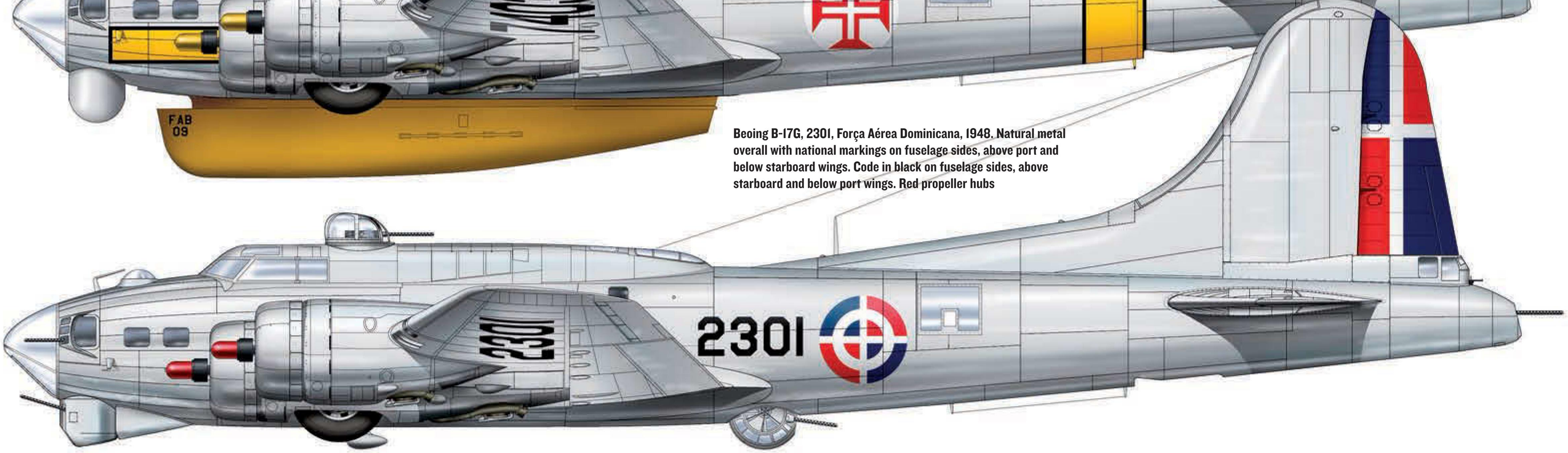
Boeing Fortress Mk III, KJ101, BU-H, No.214 Squadron RAF (100 Group), 1944. Dark Earth/Dark Green upper surfaces with Night undersides; codes and serials in Red. Blue/Red roundels above wings. 214 Sqn was a Radio Countermeasures unit (RCM) equipped with H2S radome below the nose



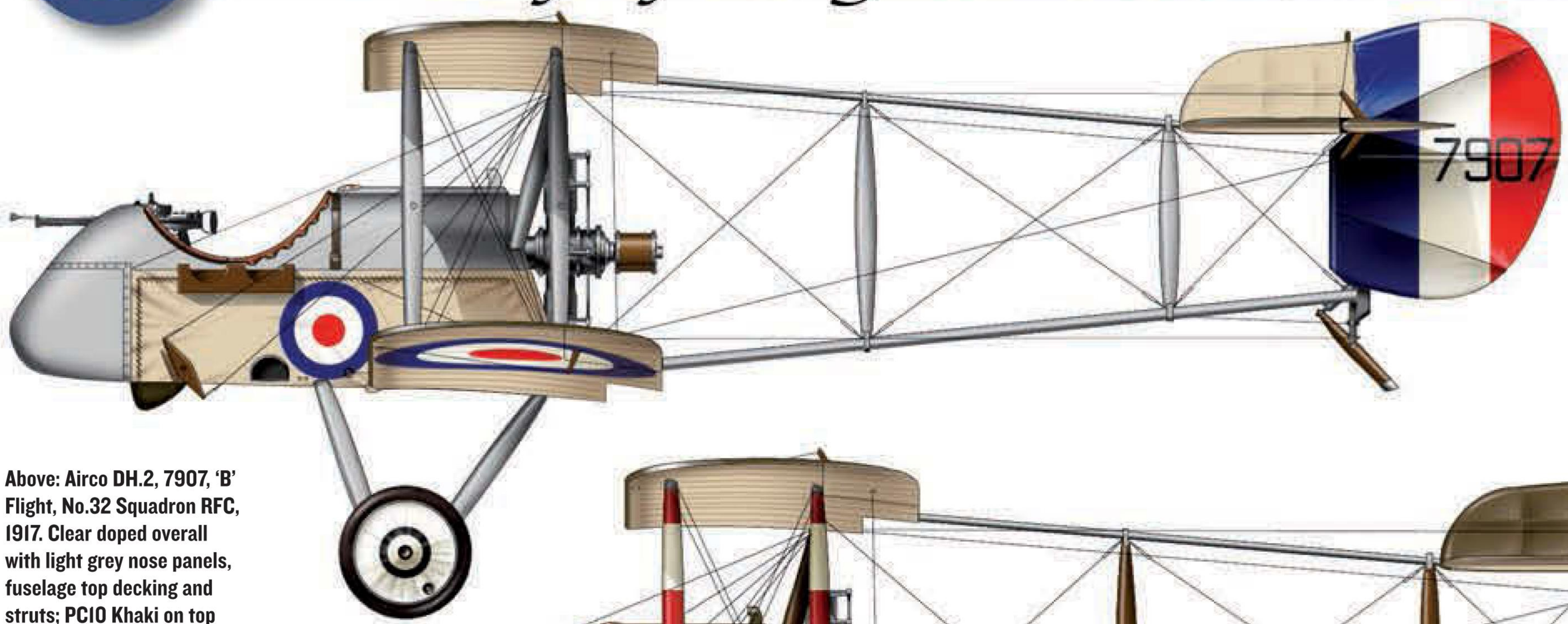
Boeing SB-17G, 7403, Força Aérea Portuguesa, BA4 Lages (Azores),1953. Natural metal overall with black anti-dazzle panel and white fuselage top decking. Yellow panels, outlined in black, on nose, around wingtips and around rear fuselage. Serial on fin in black., repeated starboard port and below port wings. National markings on fuselage sides, above port and below starboard wings



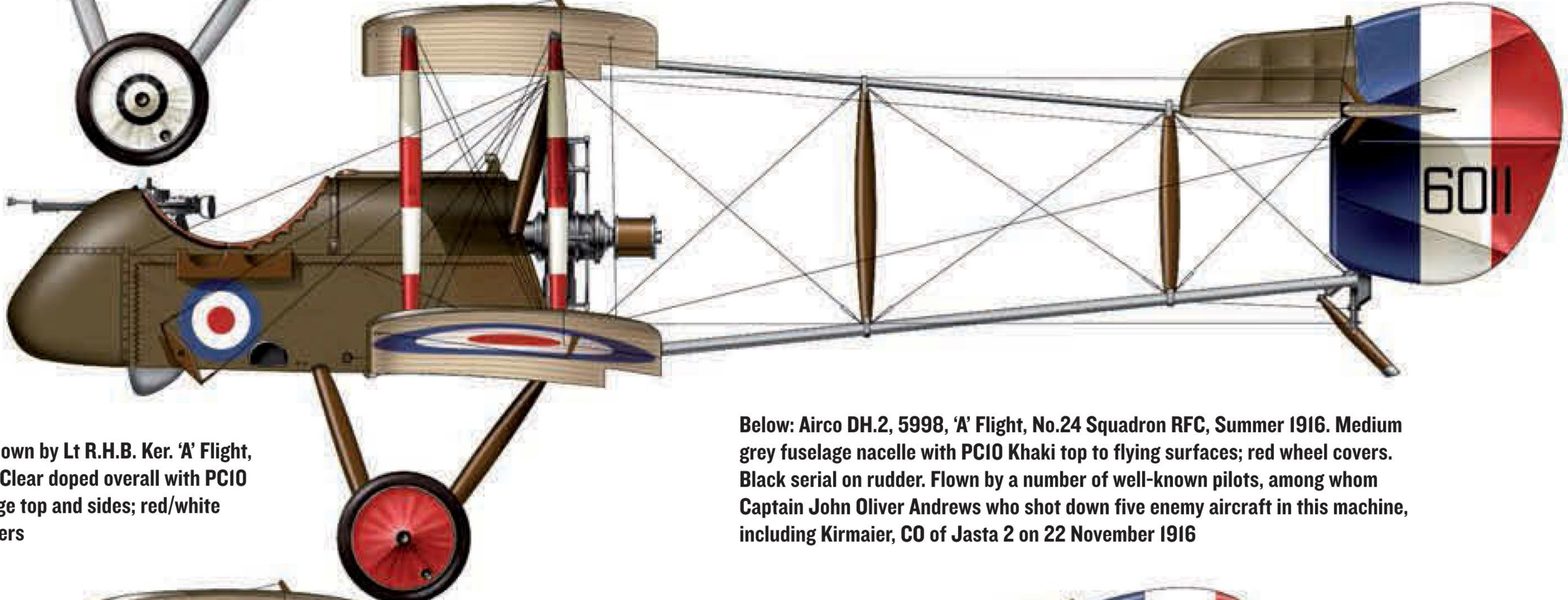
Beoing B-17G, 2301, Força Aérea Dominicana, 1948. Natural metal overall with national markings on fuselage sides, above port and below starboard wings. Code in black on fuselage sides, above starboard and below port wings. Red propeller hubs



Aircraft of the Great War (1914-1918)

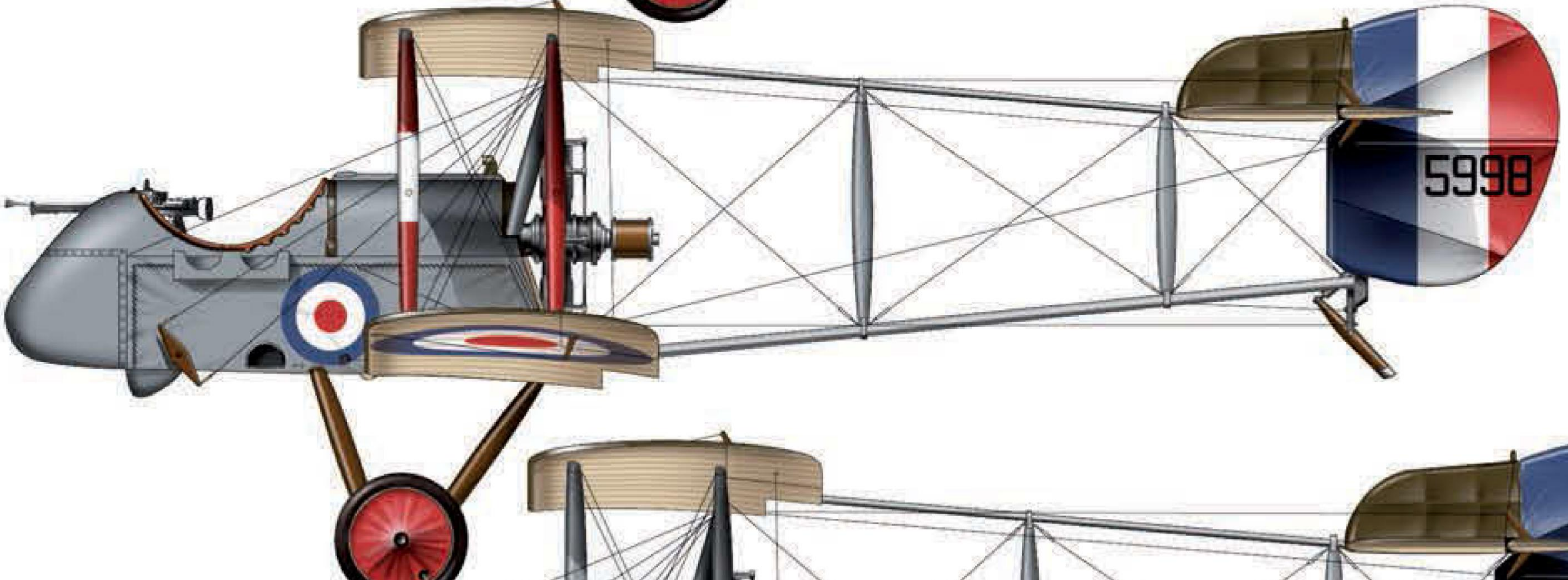


Above: Airco DH.2, 7907, 'B' Flight, No.32 Squadron RFC, 1917. Clear doped overall with light grey nose panels, fuselage top decking and struts; PC10 Khaki on top of wings and horizontal tails surfaces. White wheel covers with black circle



Above Right: Airco DH.2, 6011, flown by Lt R.H.B. Ker. 'A' Flight, No.24 Squadron RFC, July 1916. Clear doped overall with PC10 Khahi uppersurfaces and fuselage top and sides; red/white interplane struts. Red wheel covers

Below: Airco DH.2, 5998, 'A' Flight, No.24 Squadron RFC, Summer 1916. Medium grey fuselage nacelle with PC10 Khaki top to flying surfaces; red wheel covers. Black serial on rudder. Flown by a number of well-known pilots, among whom Captain John Oliver Andrews who shot down five enemy aircraft in this machine, including Kirmaier, CO of Jasta 2 on 22 November 1916



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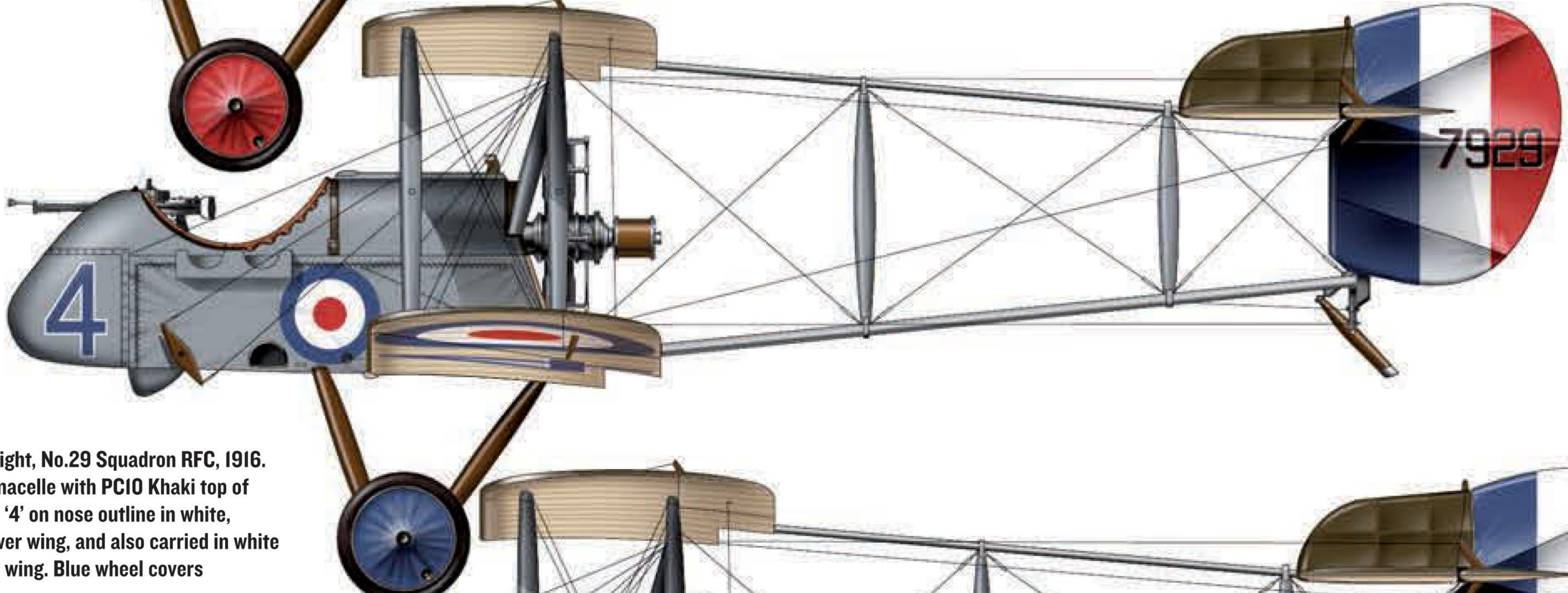
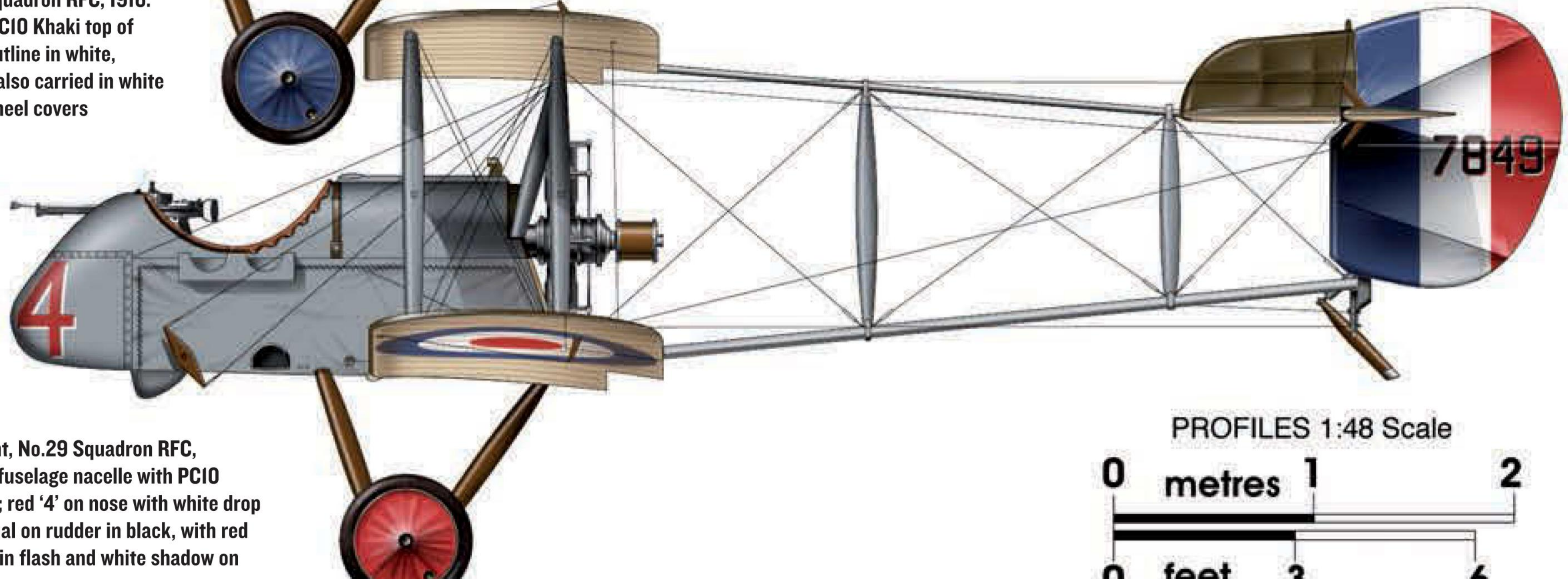


Airco DH.2, 7929, 'C' Flight, No.29 Squadron RFC, 1916. Medium Grey fuselage nacelle with PC10 Khaki top of all flying surfaces; blue '4' on nose outline in white, repeated below port lower wing, and also carried in white above top of port upper wing. Blue wheel covers



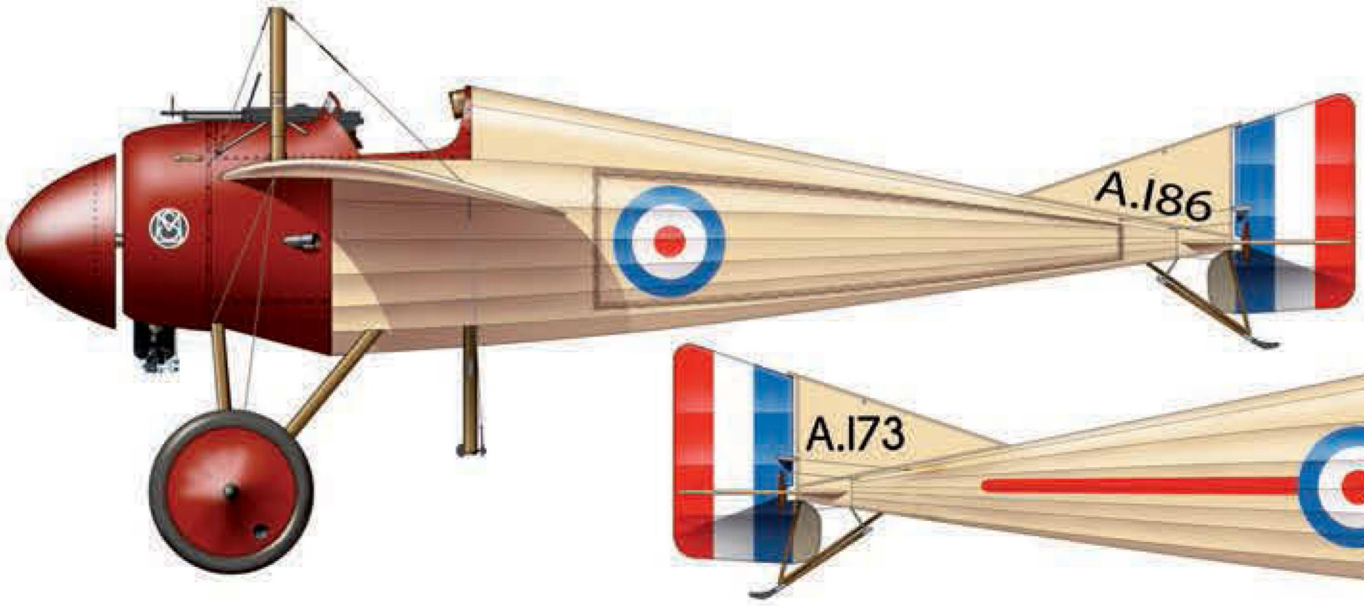
Left: Airco DH.2, 7849, 'A' Flight, No.29 Squadron RFC, September 1916. Medium grey fuselage nacelle with PC10 Khaki top of all flying surfaces; red '4' on nose with white drop shadow. Red wheel covers; serial on rudder in black, with red drop shadow on white area of fin flash and white shadow on red area

PROFILES 1:48 Scale

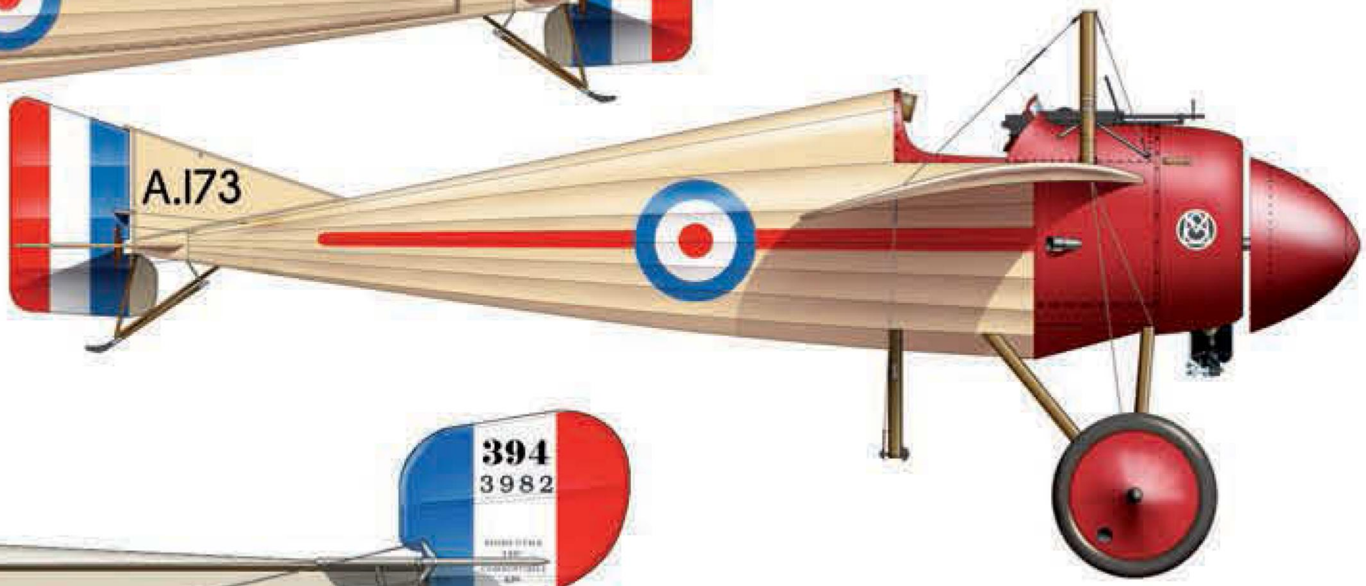
0 metres 1 2

0 feet 3 6

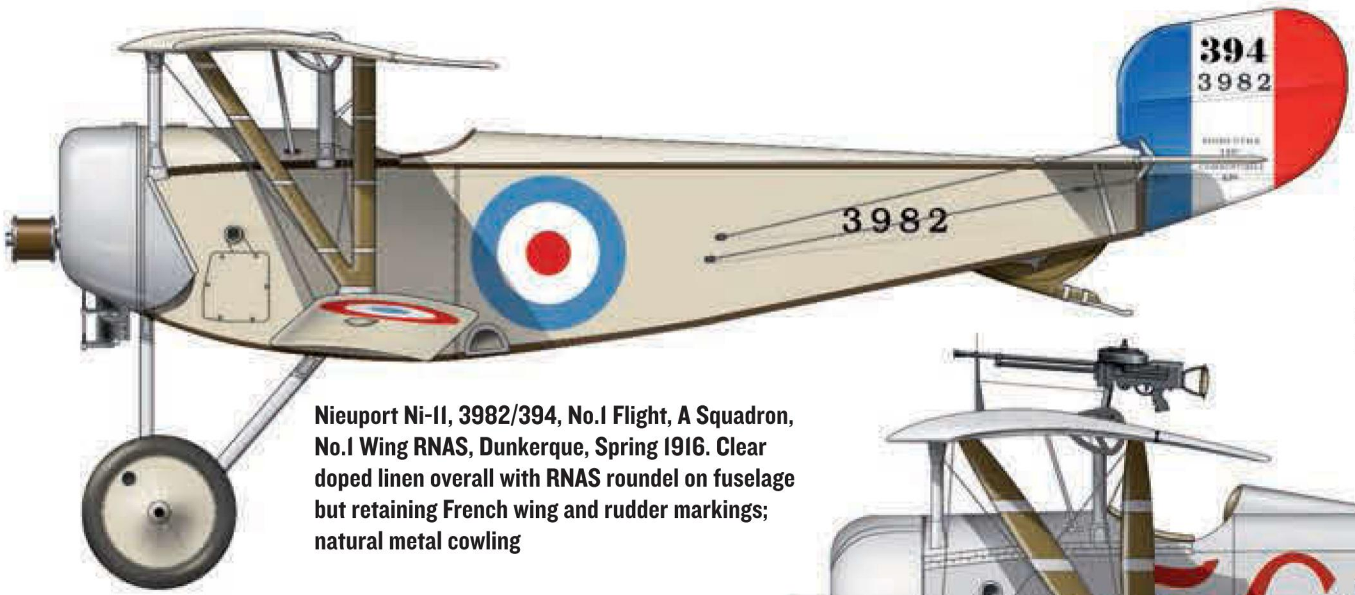
Royal Flying Corps, Royal Naval Air Service, Royal Air Force



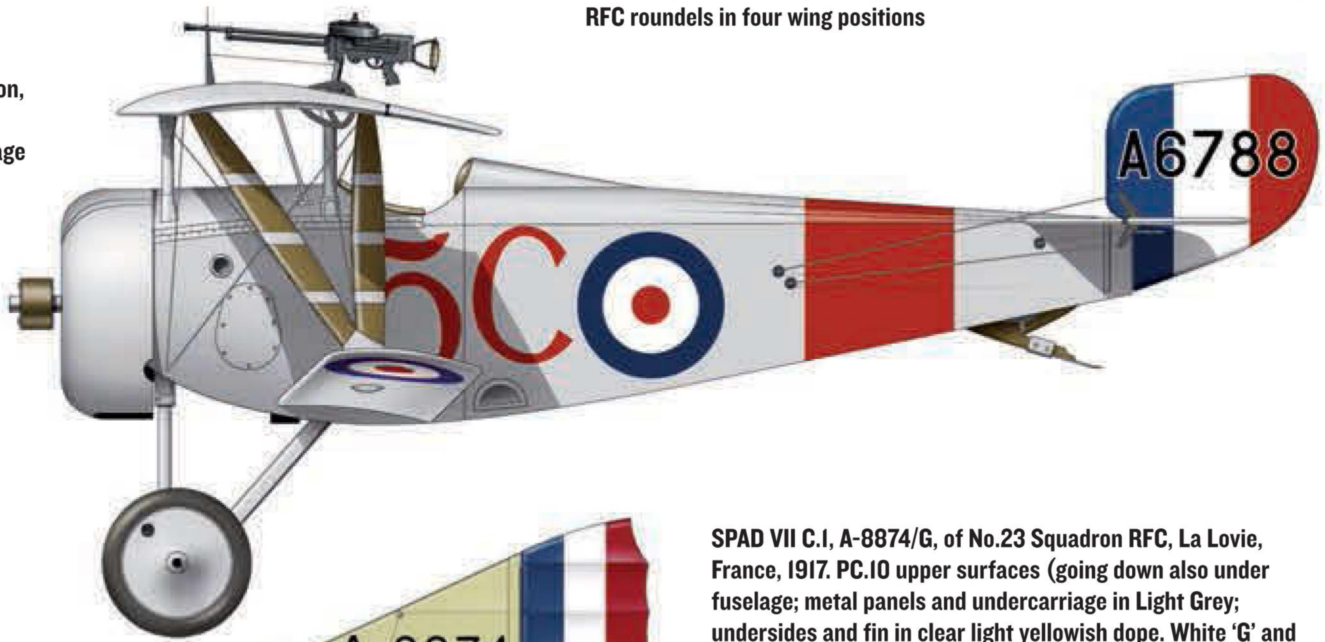
Morane-Saulnier Type N, A.186, flown by Lt Bayetto, No.60 Squadron, RFC, 1916. Doped linen overall with front section and wheel covers in red; serial in black on fin. RFC roundels in four wing positions



Morane Saulnier Type N, A.173, flown by Lt B.M. Wainwright, No.60 Squadron RFC, which fell into German hands on 28 August 1916. Standard finish with a red bar along the fuselage; photo evidence shows a dark colour above the elevators, which could possibly have also been in red. Serial in black on fin; RFC roundels in four wing positions



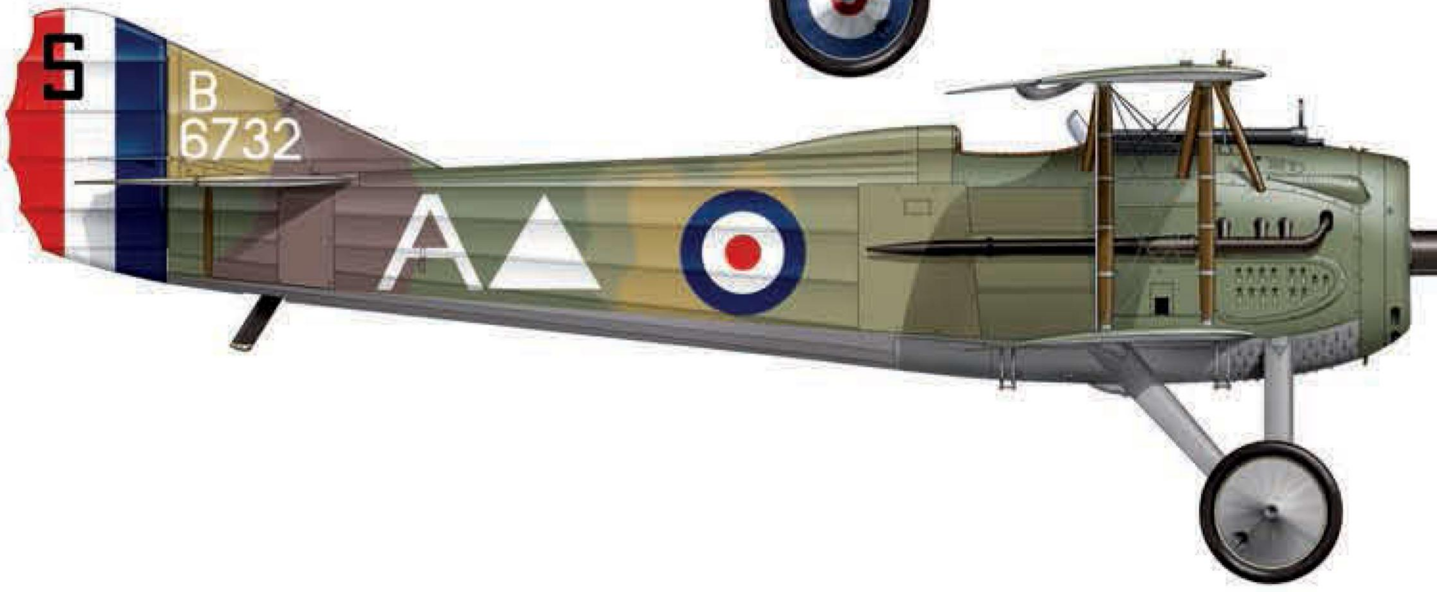
Nieuport Ni-11, 3982/394, No.1 Flight, A Squadron, No.1 Wing RNAS, Dunkerque, Spring 1916. Clear doped linen overall with RNAS roundel on fuselage but retaining French wing and rudder markings; natural metal cowling



Nieuport Ni 17, A6788/5C, 'C' Flight, No.29 Squadron RFC, 1917. Aluminium overall with red rear fuselage band and codes '5C' below cockpit. Black serial on rudder outlined in white

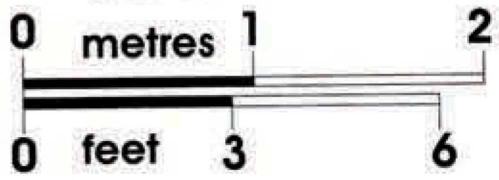
SPAD VII C.1, A-8874/G, of No.23 Squadron RFC, La Lovie, France, 1917. PC.10 upper surfaces (going down also under fuselage; metal panels and undercarriage in Light Grey; undersides and fin in clear light yellowish dope. White 'G' and triangle on fuselage

SPAD VII C.1, B1627, No.19 Squadron RFC, 1917. Light yellowish overall dope with beige front fuselage section including u/c legs. Red/white/blue fuselage stripes, and a roundel painted on wheel hub covering. Lt S.F. Allaburton was shot down in this aircraft over Harnes on May 19, 1917



SPAD XIII, B6732/A, No.23 Squadron, RFC. Vert Clair (FS.14255), Vert Foncé (FS.24098 – 34088), Beige (FS 33448); Brun (FS.20140), Noir (FS.37038) upper surfaces with blue-grey (FS.16357-16360) undersides. Roundels in four wing positions; code, serial and triangle in white

PROFILES 1:48 Scale



Aircraft of the Great War (1914-1918)

Sopwith Pup, B1719/4, No.46 Squadron, RFC. PC.10 upper surfaces with natural metal cowl and natural wood forward fuselage; clear doped undersides. Roundels outline in white on fuselage sides and above top wings, standard roundels below wings. White code and serial

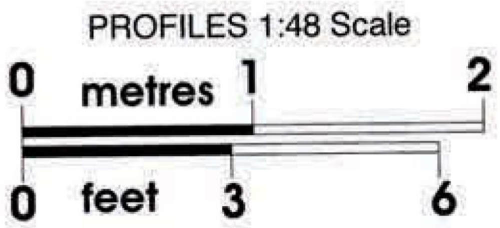
Sopwith Pup, B2162/N, flown by Lt W.A. Pritt, No.66 Squadron RFC, Estrée-Blanche (France), September 1917. PC.10 upper surfaces with clear doped linen undersides; white bar along fuselage sides with code 'N' superimposed. Black serial on white background on fin; light blue/white wheel covers. Note Lewis gun above top wing

Sopwith Pup, N6183, flown by Flt Cdr J.A. Glen, No.2 Naval Squadron RNAS, France, spring 1917. PC.10 upper surfaces with clear doped linen undersides and fin; red cowling. Black serial over a white background on fuselage sides; 'Mildred H.' in red with white drop shadow. Blue/white/red wheel covers

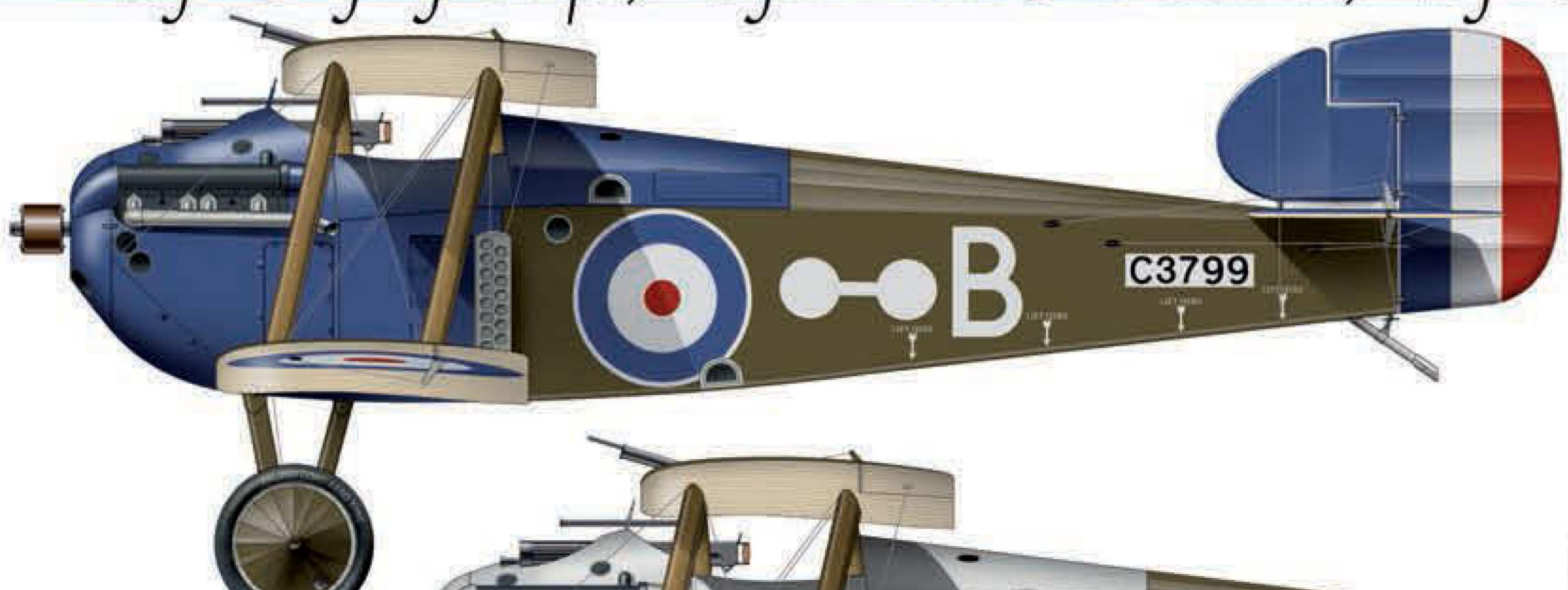
Sopwith Triplane, N6301, 'Dusty II', flown by R. McDonald, No.8 Naval Squadron RNAS, St Eloi (France) May 1917. PC.10 upper surfaces with clear doped linen undersides. Red band, edged in white, around fuselage. White fin with red diamond superimposed. Name below cockpit in white. Black serial over white background

Sopwith Triplane, N5490/C, flown by Sub-Lt Raymond Collishaw, 'B' Flight, No.10 Naval Squadron RNAS, April 1917. PC.10 upper surfaces with clear doped linen undersides. wheel covers and fin. Steel cowling and front fuselage panels. White code, black serial over white background

Sopwith Triplane, N6307/S, flown by Flt Sub-Lt John Sharman, No.10 Naval Squadron RNAS, Droglandt (France), July 1917. PC.10 upper surfaces with clear doped linen undersides. Blue cowling, wheel covers and fin. Serial and code in white

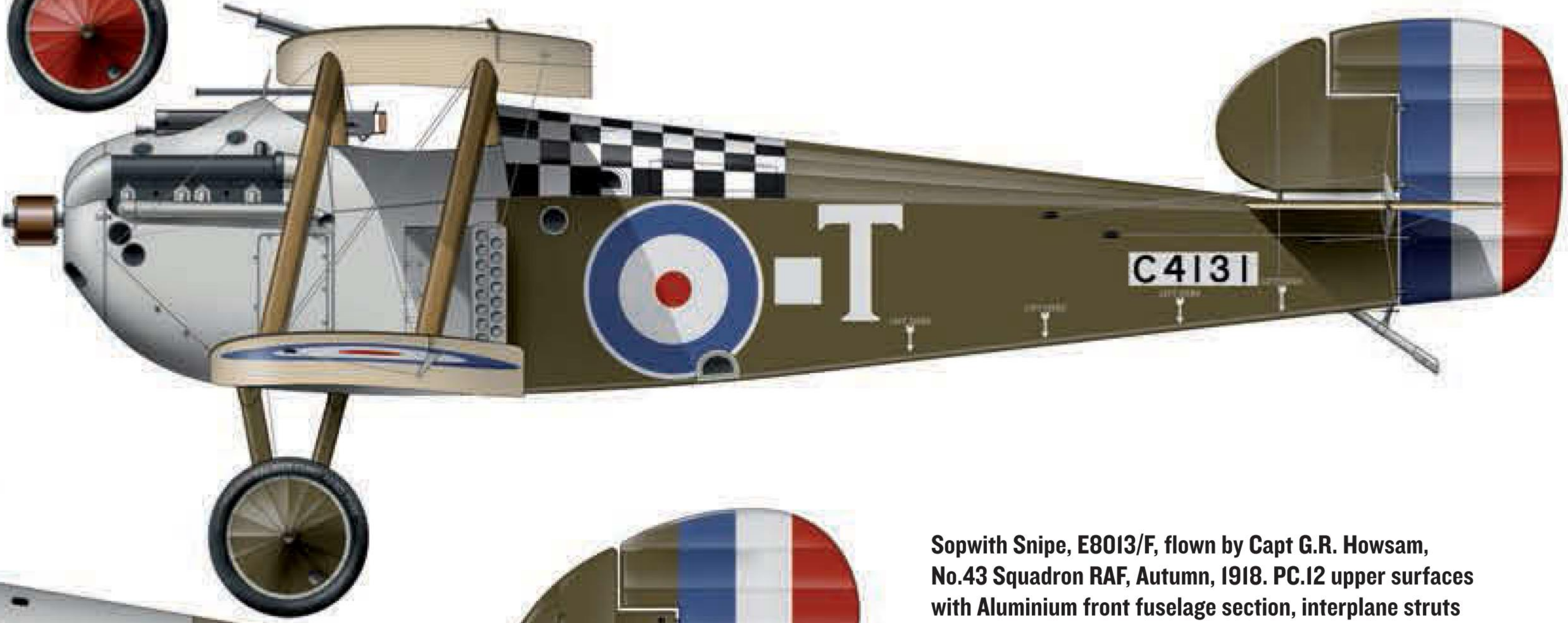


Royal Flying Corps, Royal Naval Air Service, Royal Air Force



Sopwith Dolphin, C3799/B, flown by Capt G.B. Irving, No.19 Squadron RAF, summer 1918. PC.12 upper surfaces with blue nose section, fin and top of tailplanes. White markings on fuselage sides, black serial over white background

Sopwith Dolphin, C3829/V, No.19 Squadron RFC, 1918. PC.12 upper surfaces with Aluminiun front fuselage; clear doped linen undersides. White markings on fuselage sides, black serial over white background. Red wheel covers



Sopwith Dolphin, C4131/T, flown by Maj N.W. Noel, No.79 Squadron RAF, summer 1918. PC.12 upper surfaces with Aluminium front section of fuselage. Clear doped linen undersides. Black/White checks on rear fuselage top decking. White markings, black serial over white background. 'T' repeated in white above both sides of top wings, inboard of roundels

Sopwith Snipe, E8013/F, flown by Capt G.R. Howsam, No.43 Squadron RAF, Autumn, 1918. PC.12 upper surfaces with Aluminium front fuselage section, interplane struts and undercarriage struts; clear doped linen undersides. White markings. 'F' repeated in white above top port wing inboard of roundel

Model AIRPLANE INTERNATIONAL
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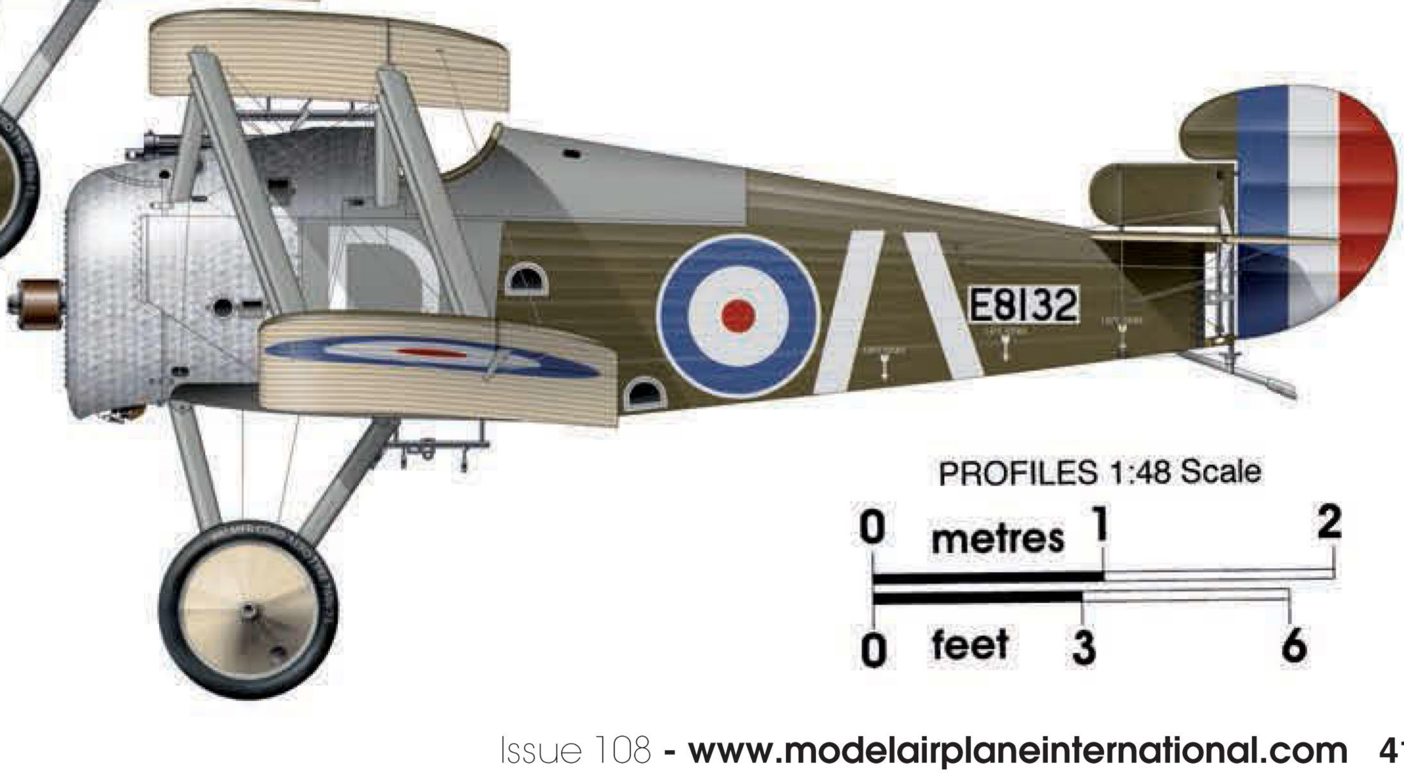
Sopwith Snipe, E8102, flown by Maj W.G. Baker, DSO, MC, attached to No.201 Squadron Royal Air Force, October 1918. PC.12 upper surfaces with Aluminium cowling and front fuselage panels; clear doped linen undersides. White bands around rear fuselage. Black serial over white background



Sopwith Snipe, E8132/D, A Flight, No.208 Squadron, November 1918. PC.12 upper surfaces with steel cowling and Service Grey front fuselage panels; clear doped linen undersides and white covers. White markings with 'D' repeated above top starboard wing inboard of roundel. Black serial on white background

PROFILES 1:48 Scale

0 metres 1 2

0 feet 3 6

Aircraft of the Great War (1914-1918)

Sopwith F.1 Camel, B3883 'Maud II', flown by Sub-Lt H.F. Stackard, No.9 Naval Squadron RNAS, Leffrinckhoucke, September 1917. PC.10 upper surfaces with Aluminium cowling and forward fuselage panels. Blue/white motif on rear fuselage. White serial on fin. 'Maud II' in blue with white drop shadow

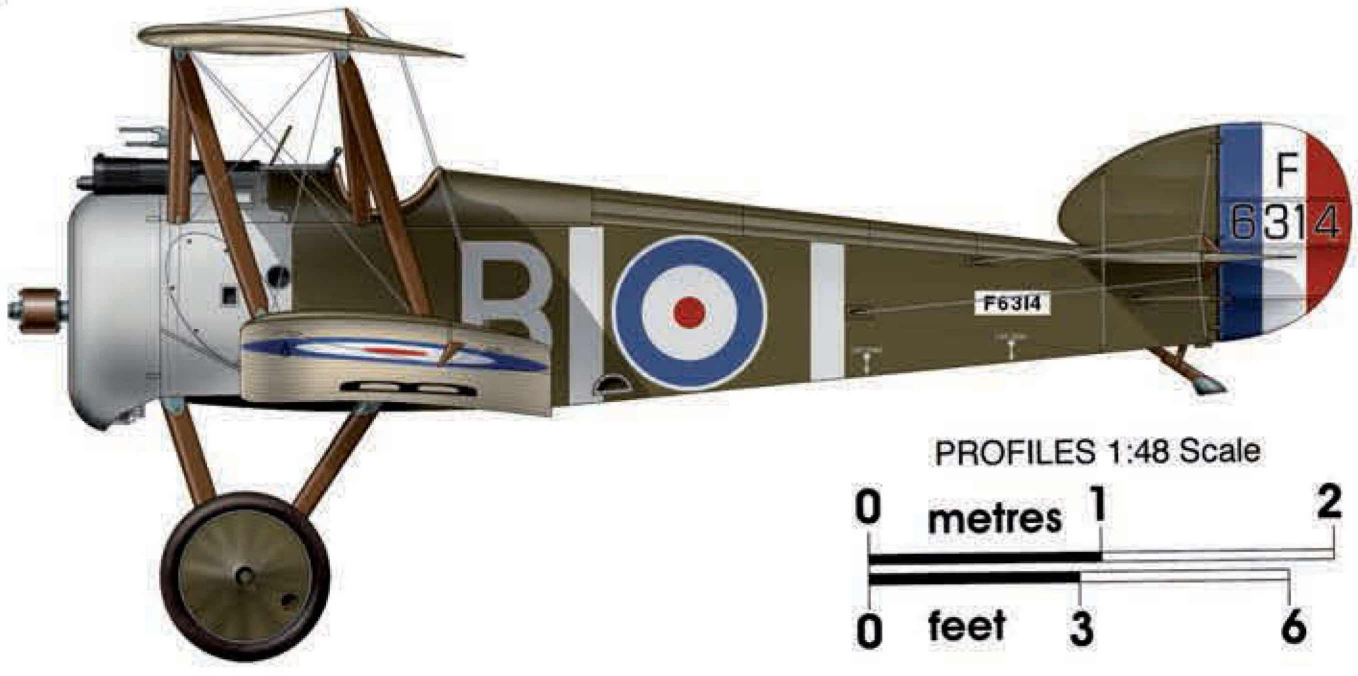
Model AIRPLANE INTERNATIONAL Original Artwork by Richard J. Caruana © MAI 2014

Sopwith F.1 Camel, B5663/A, flown by Lt W.A. Curtis, No.10 Naval Squadron RNAS, Teteghem, late 1917. PC.10 upper surfaces with black/white trim to cowling, front fuselage panels and wheel covers. White fuselage markings and serial

Sopwith F.1 Camel B6363/K, flown by Capt J.H. Mitchell, 'B' Flight Commander No.28 Squadron RFC, Grossa, November 1917. PC.10 upper surfaces with Aluminium engine cowling and forward fuselage panels. White markings

Sopwith F.1 Camel, B6385/W, No.3 Squadron RFC, 1918. PC.10 upper surfaces with clear varnished wooden panels around cockpit. White markings with black serial over white background

Below: Sopwith F.1 Camel F2137/U, flown by Capt Donald R. McLaren, No.46 Squadron RFC. PC.12 upper surfaces with natural metal cowl and natural wood forward fuselage; clear doped linen undersides. White codes and serials



Sopwith F.1 Camel, F6314/B, No.65 Squadron RAF, June 1918. PC.12 upper surfaces with Aluminium front fuselage and cowling. Clear doped linen undersides. White markings with black serial on fuselage over a white background. Serial repeated on rudder, outlined in white

PROFILES 1:48 Scale

0 metres 1 2

0 feet 3 6

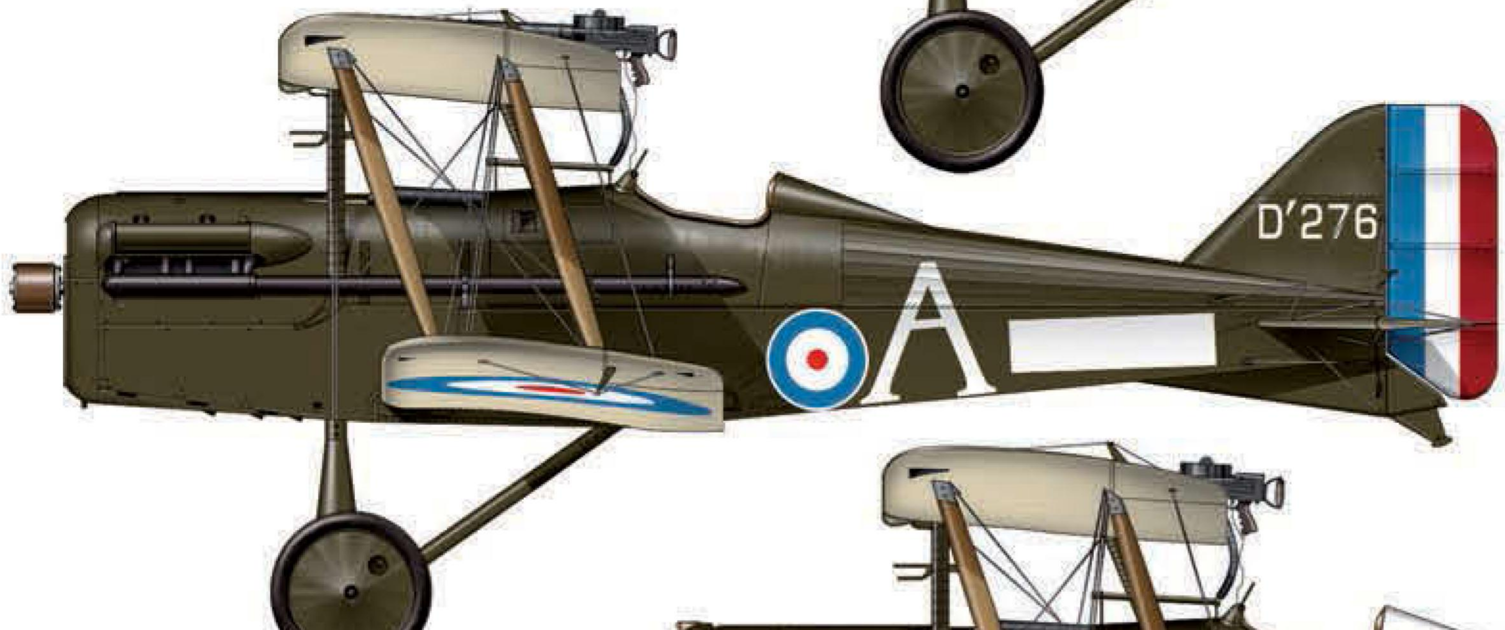
Royal Flying Corps, Royal Naval Air Service, Royal Air Force

Below: S.E.5 A-8898, flown by Capt K.L. Caldwell, No.60 Squadron RFC, August 1917. PC.10 overall with clear doped linen undersides of wings, tailplanes and rear fuselage; red decorations to nose and rear fuselage, outlined in white. Red wheel covers; white top half of fin with green fern emblem. Serial in white. Note modified cockpit and long exhaust pipe

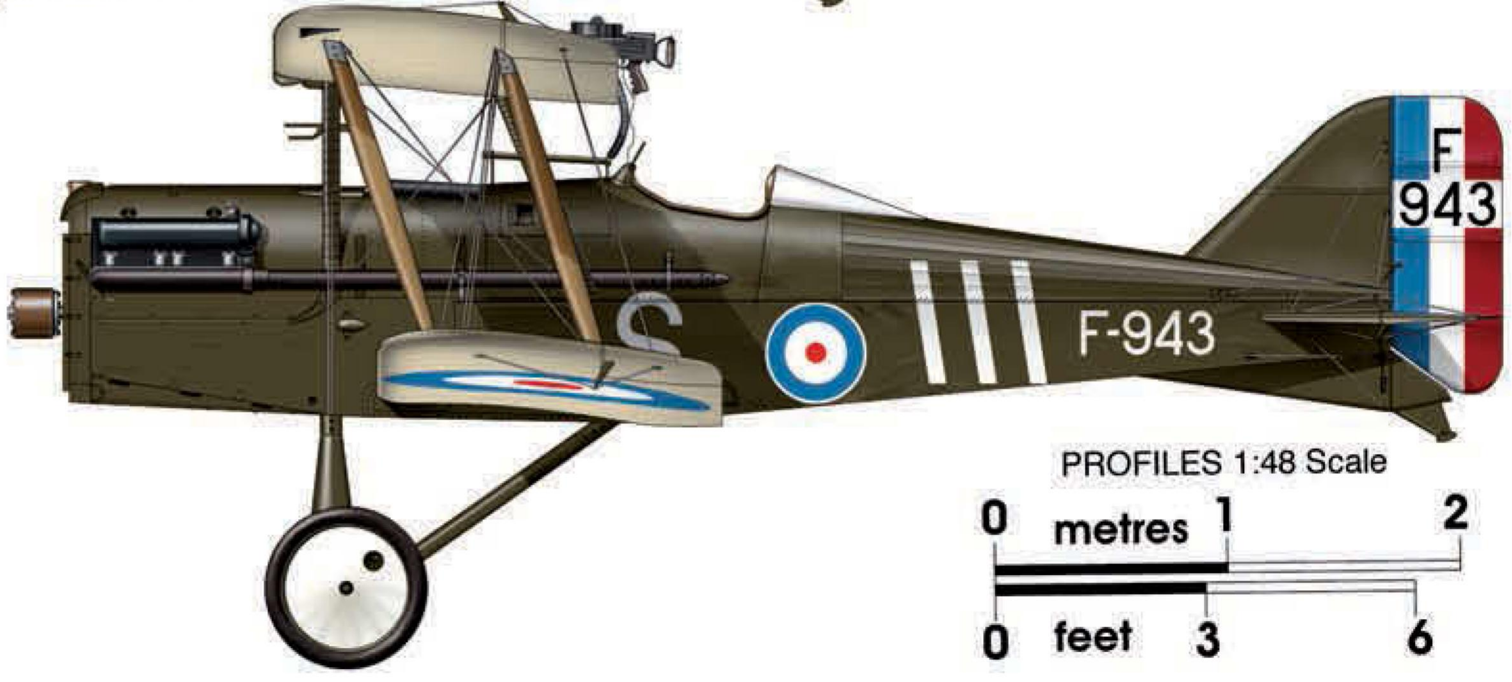
Above: S.E.5, A-4853, No.56 Squadron RFC, Estrée Blanche (France), May 1917. PC-10 overall with clear doped linen undersides of wings, tailplane and rear fuselage; lettering in white. Wheel covers in blue

S.E.5a (Wolseley Viper), C1096/3, flown by Lt H.J. 'Hank' Burden, No.56 Squadron RAF, 1918. PC.10 overall with clear doped linen undersides of wings, tailplane and rear fuselage; all lettering in white (including 'Maybe?' on engine cowling). '3' repeated in white above top wing, inboard of starboard roundel, and in black (some sources quote blue) below starboard wing, inboard of roundel. Blue/white wheel covers; note shortened exhaust pipe

S.E.5a (Wolseley Viper), C-1904/Z, No.85 Squadron RAF, St Omer (France), June 1918. PC.10 overall with clear doped linen undersides of wings, rear fuselage and tailplane; all markings and lettering in white. 'Z' repeated in white above top wing, inboard of staboard roundel



S.E.5a (Hispano-Suiza), D'276, flown by 'Mick' Mannock, No.74 Squadron RAF, France, April 1918. PC.10 overall except for undersides of wings and tailplane which are clear doped; white code, serial and bar on fuselage sides. 'A' repeated in white above top wing, to starboard of centre section, and in black below port wing, between roundel and wingtip



S.E.5a (Wolseley Viper), F-943, No.92 Squadron, France, 1918. PC-10 overall with clear doped linen undersides of wings, tailplane and rear fuselage; lettering and markings on fuselage in white. Serial repeated in black on rudder; white wheel covers and headrest fairing

PROFILES 1:48 Scale

0 metres 1 2

0 feet 3 6

Aircraft of the Great War (1914-1918)

Model AIRPLANE INTERNATIONAL
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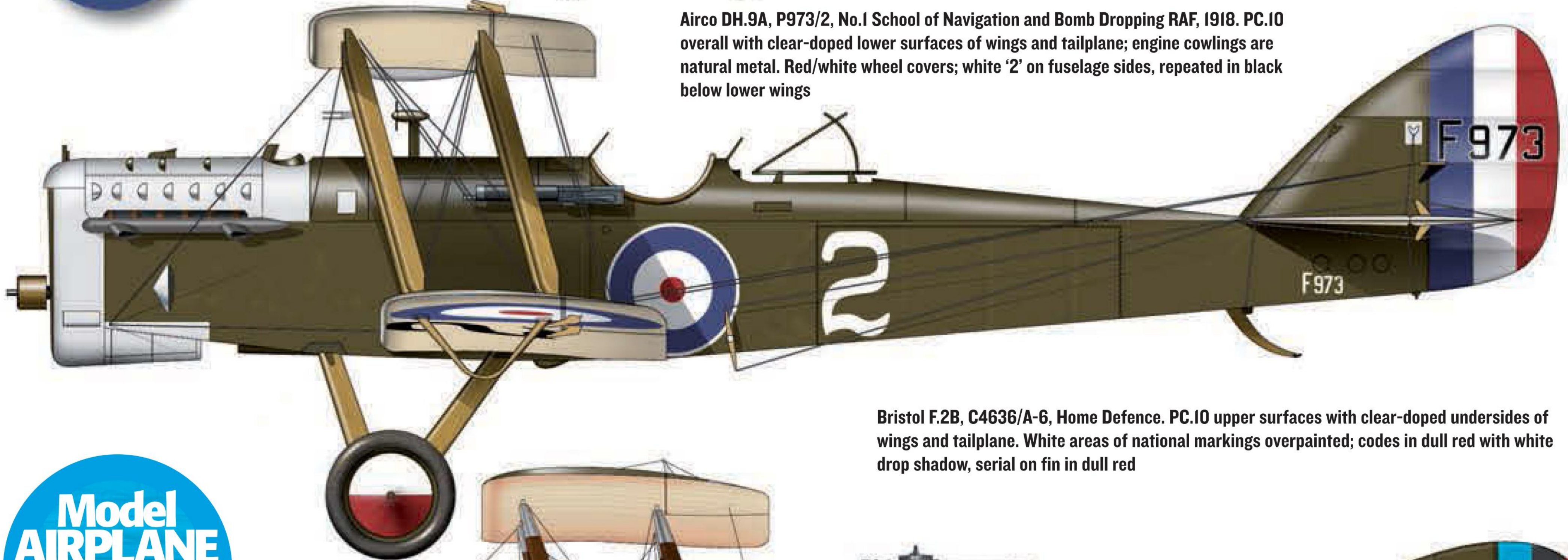
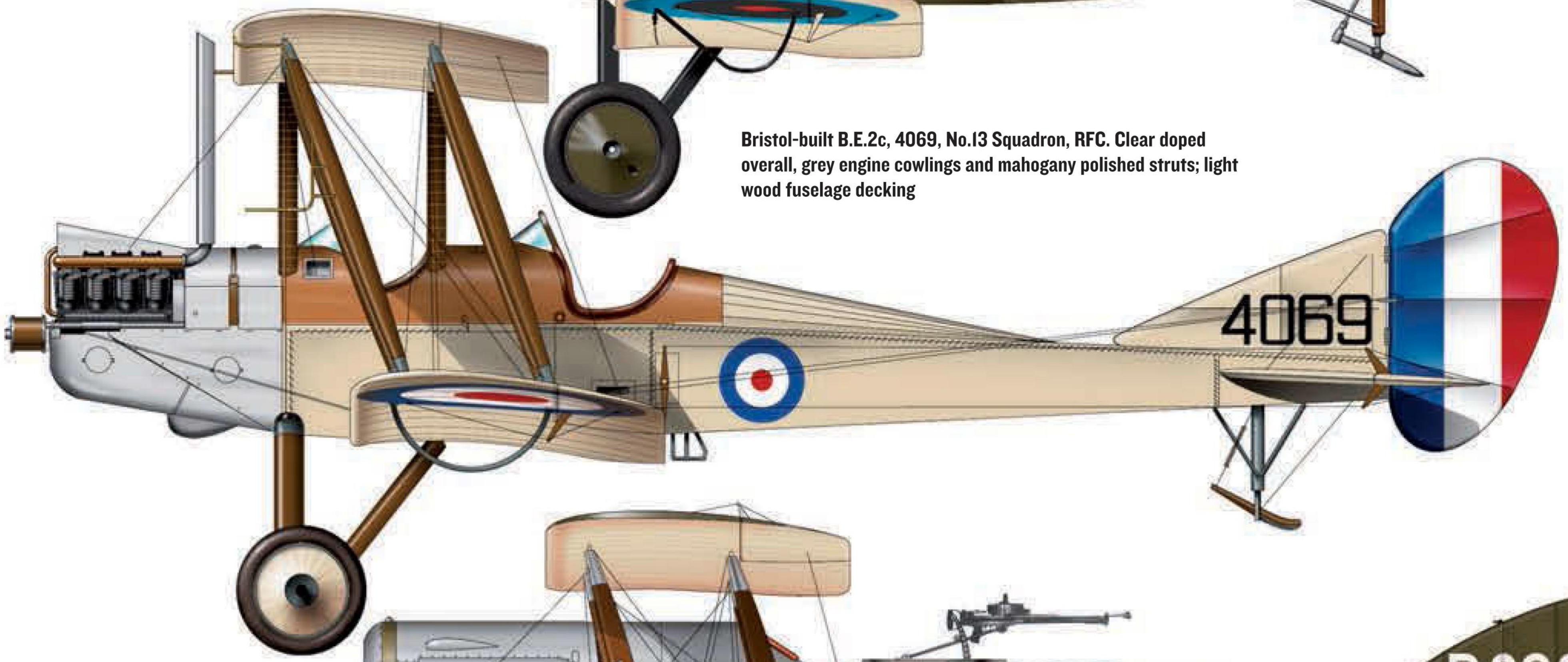
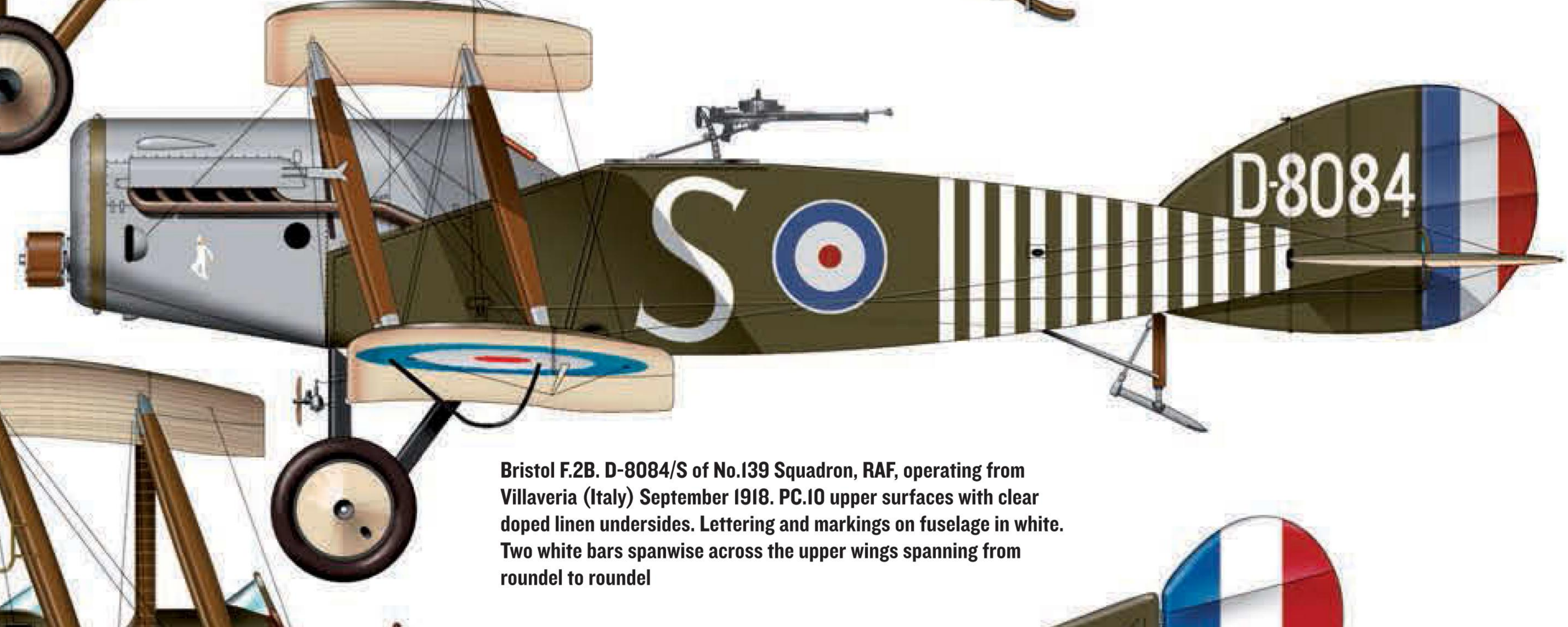


Airco DH.9A, P973/2, No.1 School of Navigation and Bomb Dropping RAF, 1918. PC.10 overall with clear-doped lower surfaces of wings and tailplane; engine cowlings are natural metal. Red/white wheel covers; white '2' on fuselage sides, repeated in black below lower wings

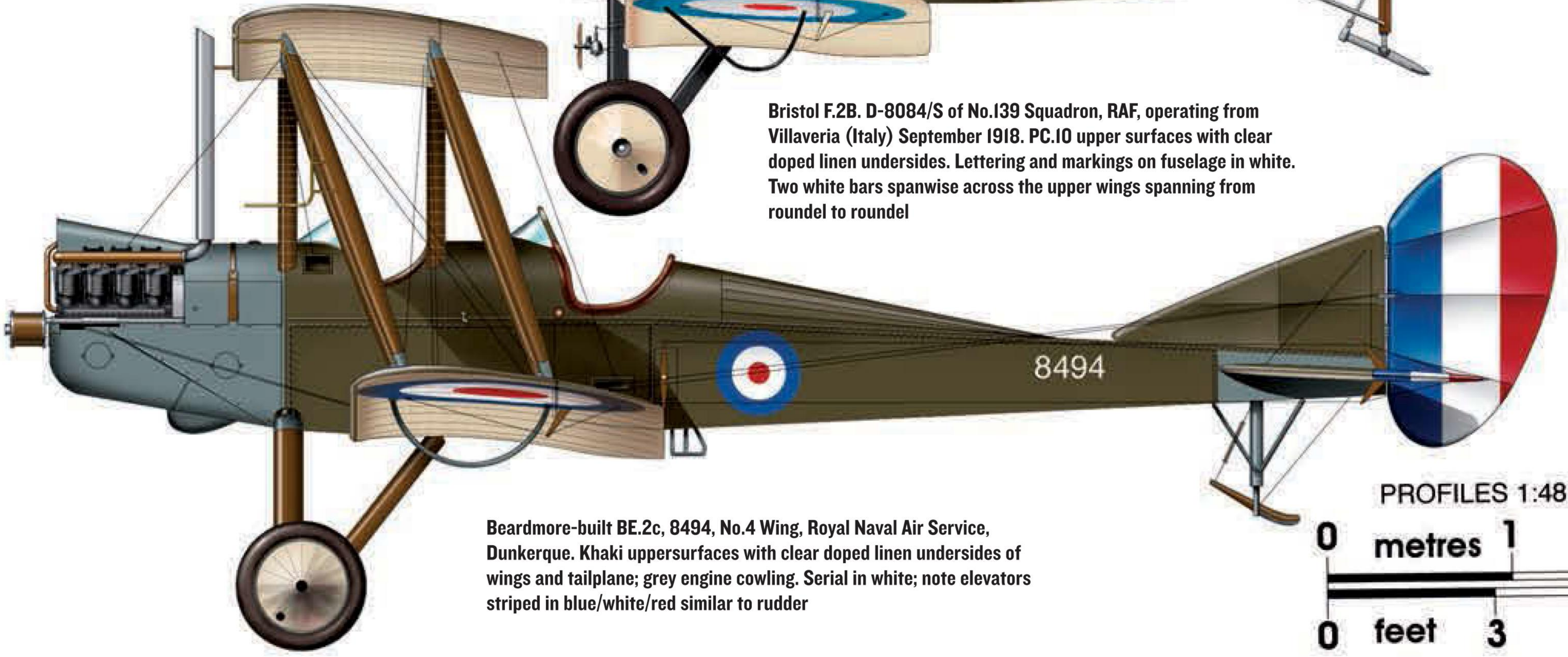
Bristol F.2B, C4636/A-6, Home Defence. PC.10 upper surfaces with clear-doped undersides of wings and tailplane. White areas of national markings overpainted; codes in dull red with white drop shadow, serial on fin in dull red



Bristol-built B.E.2c, 4069, No.13 Squadron, RFC. Clear doped overall, grey engine cowlings and mahogany polished struts; light wood fuselage decking



Bristol F.2B. D-8084/S of No.139 Squadron, RAF, operating from Villaveria (Italy) September 1918. PC.10 upper surfaces with clear doped linen undersides. Lettering and markings on fuselage in white. Two white bars spanwise across the upper wings spanning from roundel to roundel



Beardmore-built BE.2c, 8494, No.4 Wing, Royal Naval Air Service, Dunkerque. Khaki uppersurfaces with clear doped linen undersides of wings and tailplane; grey engine cowling. Serial in white; note elevators striped in blue/white/red similar to rudder

PROFILES 1:48 Scale

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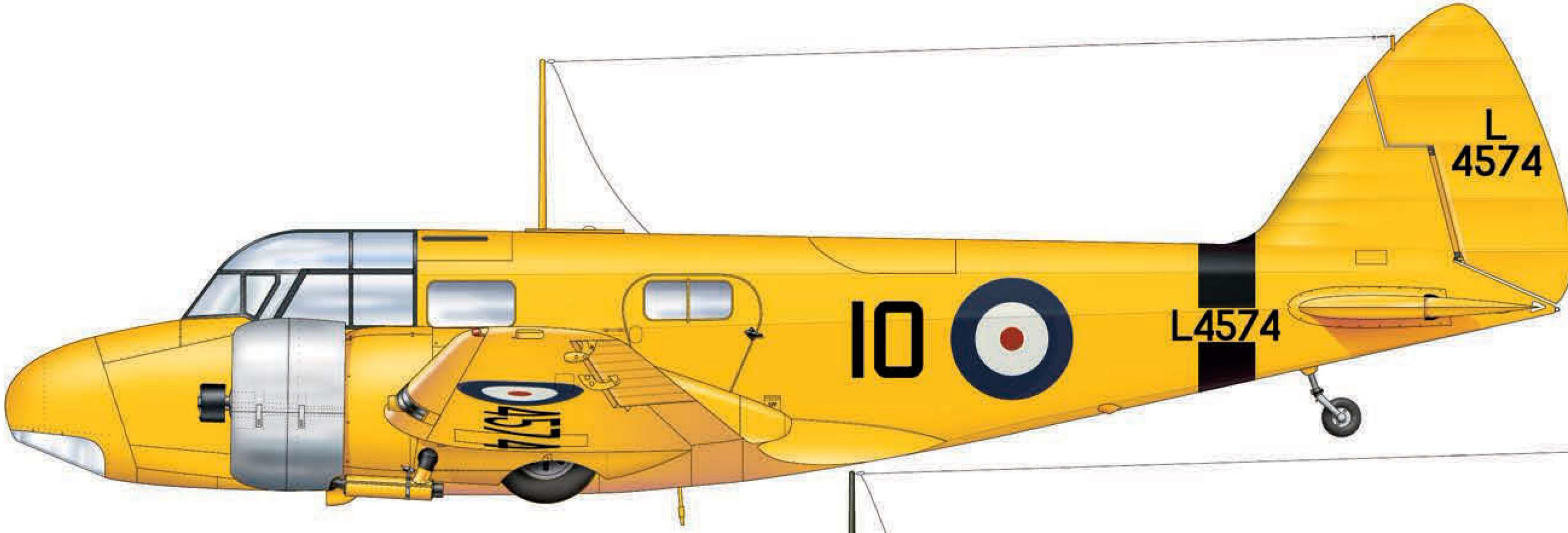
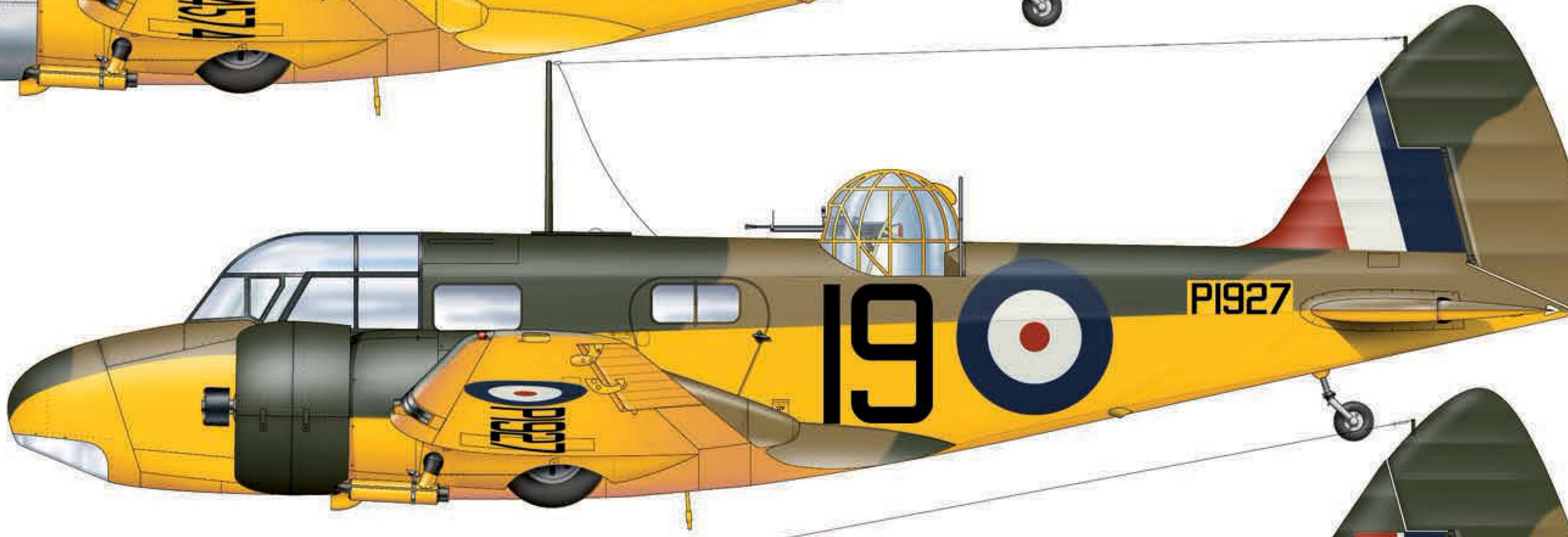
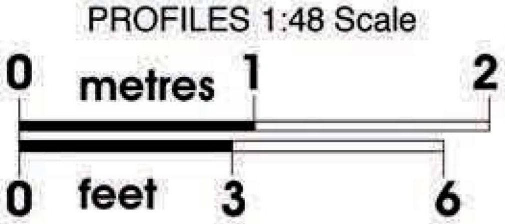




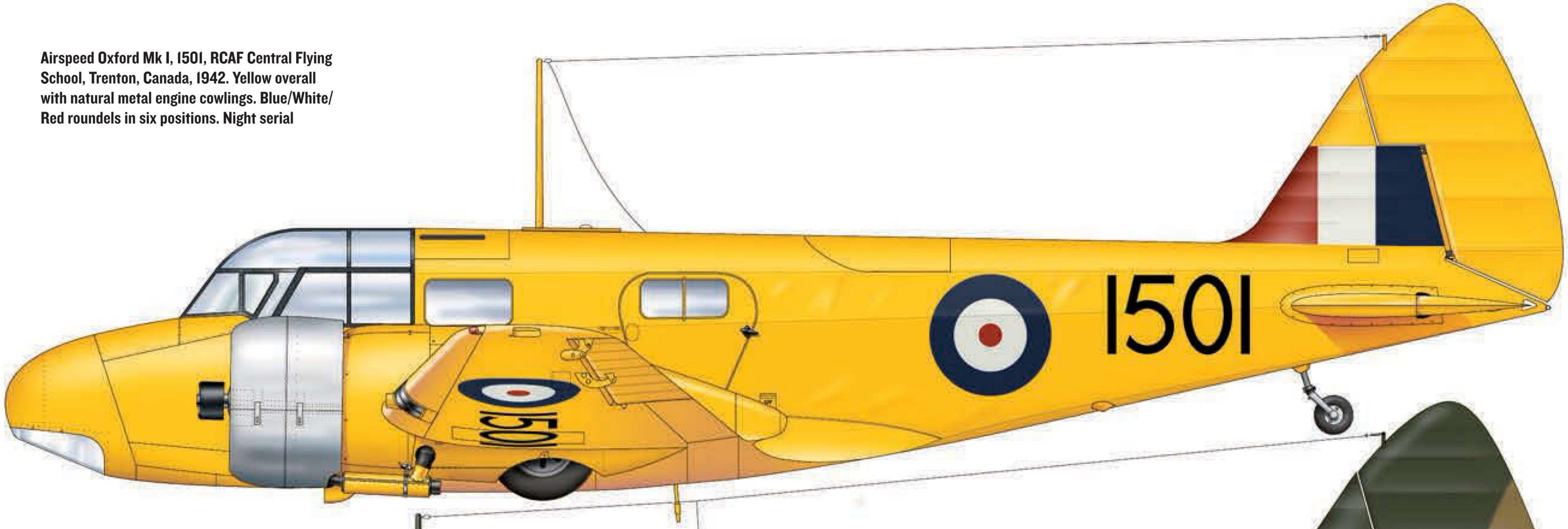
Above: Airspeed Oxford Mk I, L4574/10, No.3 Flying Training School, 1938. Yellow overall with natural metal engine cowlings. Blue/White/Red roundels in six positions. Night serial, code and rear fuselage band

Right: Airspeed Oxford Mk I, P1927/19, No.14 Service Flying Training School, Cranfield, summer 1940. Dark Earth/Dark Green upper surfaces with Ident Yellow undersides. Night serial and code. Blue/Red roundels above wings

Bottom: Airspeed Oxford Mk II (Ambulance Conversion), P8833 'Nurse Cavell', No.24 Squadron RAF, Hendon. Dark Earth and Dark Green upper surfaces with Ident Yellow undersides. Night serial, white name on nose. Blue/Red roundels above wings



Airspeed Oxford Mk I, 1501, RCAF Central Flying School, Trenton, Canada, 1942. Yellow overall with natural metal engine cowlings. Blue/White/Red roundels in six positions. Night serial



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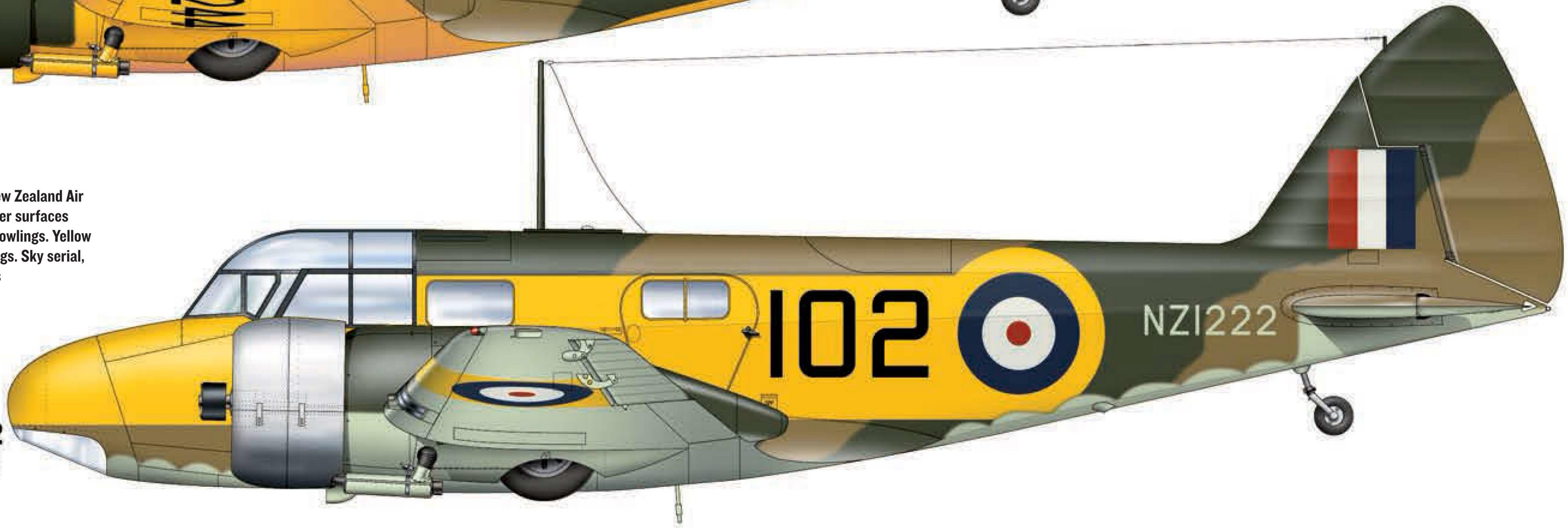
Airspeed Oxford Mk I, T1244/H5, No.6 Service Flying Training School, Little Rissington, February 1943. Dark Earth and Dark Green upper surfaces with Ident Yellow undersides. Serial and code on fuselage in white; serial below wings in Night. Blue/Red roundels above wings

Airspeed Oxford Mk I, NZ1222/102, Royal New Zealand Air Force, 1940. Dark Earth and Dark Green upper surfaces with Sky undersides. Natural metal engine cowlings. Yellow forward fuselage sides and bands below wings. Sky serial, Night codes. Blue/Red roundels above wings



PROFILES 1:48 Scale

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Lightning Does Strike Twice!

Written by Model Airplane International

Destined to be the combat aircraft of choice for a host of Western air forces, the F-35A Lightning II finally brings a 'fifth generation multi-role fighter' to the front line.

According to Lockheed Martin current and future surface-to-air missile threats are countered by the F-35's fifth-generation design. This incorporates stealth and a designed-in capability to fly and fight as part of a network, linking together multiple combat aircraft, sensor platforms, and command and control centres. In doing so, the aircraft is intended to provide an unprecedented degree of situational awareness and to accurately deliver precision-guided munitions against surface to air targets. By combining stealth and networking capabilities in an upgradeable aircraft, the F-35 Lightning II is designed to meet evolving threats for the next 30 years. For the USAF, that will operate the largest F-35A fleet, or the conventional take-off and landing (CTOL) variant, which will replace the F-15E Strike Eagle, F-16 Fighting Falcon and A-10 Thunderbolt II, the Lightning II will bring an unrivalled first strike capability that has been missing since the F-117As were retired. However, the F-35A will not serve in the numbers originally envisaged by USAF Generals back in the early 1990s, when it becomes operational between 2017 and 2019. As to how many will actually enter service is still subject to speculation despite the USAF recently announcing that the type will now be based overseas at RAF Lakenheath, Suffolk in the United Kingdom, replacing the resident F-15E Strike Eagles currently operated at the base.

The F-35 will be the only 5th generation multirole stealth fighter in western service and for the pilots their cockpit will be like no other; dominated by an L-3 Panoramic Cockpit Display

An F-35A at Edwards Air Force Base, California, is pictured with its F-35 Systems Development and Demonstration Weapons Suite the aircraft is designed to carry. The F-35A can carry 3,500lb of ordnance in Low Observable (stealth) mode and over 18,000lb if all external hard points are also used.

Early in the test programme at Edwards AFB, all six F-35A were lined up for a publicity photograph. F-35 AF-01 (pictured in the foreground) was the first CTOL example to fly in November 2009. Unlike the F-35B and C, the A model was equipped with an internal gun from the outset. All images via Lockheed Martin

Test aircraft AF-01 completed the first weapon release of an AIM-120 AMRAAM on October 19, 2012. The jettisoned the instrumented AIM-120 from its internal weapons bay over the test range at China Lake, California.

The first F-35A, AF-1 leaves the runway at Lockheed Martin's Fort Worth facility in Texas during its maiden flight on November 14, 2009. For this flight, AF-1 was flown without its specialist 'stealth coating' applied.

Moments away from arriving at Edwards Air Force Base on May 17, 2010, F-35As, AF-1 and AF-2 flew in formation for a unique photo-shoot. Of note in this view are the large instrumented pitot tubes that would not be a feature of production aircraft.

The jettisoned instrumented AIM-120 falls away from the internal weapons bay of AF-01 over the test range at China Lake, California. During the tests the aircraft was covered in black-and-white camera reference points around the fuselage area. AF-01 is the only F-35A to have worn special tail markings to date.

A Royal Danish Air Force F-16B dedicated to the USAF 461st Flight Test Squadron comes in for landing at Edwards Air Force Base, following an F-35A weapon release test mission in July 2013.

(PCD) incorporating touch screen control. The tactical information is displayed across four windows called portals 1,2,3 and 4 left to right. The F-35A pilot is able to place anything anywhere and change the size of the portals. Many USAF test pilots are currently with the flying tactical information display on one side and all the sensors on the other. For the F-35A pilot, the picture presented on the display is very easy to interpret. Surprisingly there is no head-up display (HUD) in the F-35; everything that would normally be placed on this is displayed through the Gen II Helmet-Mounted Display System visor, which is focussed on infinity, so allowing the pilot to achieve a level of situational awareness unrivalled - without them having to simply remain looking ahead, wherever they look, the tactical information they need will follow their line-of-sight through the helmet display.

On the right hand side of the cockpit is the side stick controller, while on the left is the throttle. There are hardly any levers or switches in the cockpit, which minimises the cockpit clutter; only essentials are included, such as landing gear handle, emergency release, and engine start controls. All other controls are activated through the touch screen or voice activated by the pilot.

Currently there are 109 operational F-35s, which were preceded by 14 prototypes and development aircraft. Despite well publicised problems and cost overruns with the aircraft, Lockheed Martin's use of a common core fuselage, will mean that delivers of F-35As for the USAF, Australian, Norwegian, Italian, Israeli, Turkish, Japan, Republic of Korea and The Netherlands air forces will all receive their allotted aircraft by 2018. For the Israeli Air Force, their F-35Is will be based on the F-35A airframe but fitted with undisclosed Israeli-specific equipment.

Home of the Lightning

So what and where are the F-35As which are currently undergoing evaluation operating from and with what units? The US Air Force took delivery of the first prototype F-35A, AA-1 on October 1, 2008 when it arrived at Edwards Air Force Base for testing. It was joined by four more development aircraft: AF-01 and AF-02, both on May 17, 2010; AF-03 on December 10, 2010; and AF-04 on January 22, 2011.

The first two production aircraft, AF-06 and AF-07, were delivered on May 13, 2011 and May 6, 2011 respectively.

Not surprisingly, as stated above, the majority of the F-35A fleet is located at Edwards Air Force Base, California. The USAF's 31st Test and Evaluation Squadron and 461st Flight Test Squadron, both primarily fly the F-35A, along side the Royal Netherland's Air Force 323 Squadron, currently equipped with two F-35As. The 461st Flight Test Squadron is tasked with the system development and demonstration phase of the Joint Strike Fighter flight testing, using six F-35As as part of a joint military, government and contractor team. It is responsible for ground and flight test of the USAF F-35A variant.

The 31st Test and Evaluation Squadron carries out the operational testing of the F-35A. The unit has four of these aircraft that are used to evaluate the variant, its support equipment and the logistics supply system. The goal of the squadron is to determine the best use of the F-35A in a 'real-world' combat. Testing will include evaluating the F-35A's survivability in specific situations and the execution of flight operations both at home or in a combat zone. Some operational testing of the F-35A is also being conducted at Nellis Air Force Base, Nevada.

Nellis was one of the first bases to operationally test the F-35. Specially selected ground crews provide test support, drive development evaluation and support the initial operational test and evaluation programme. Conclusions drawn from these teams will establish how the F-35A will be used in theatre. The 422nd Test and Evaluation Squadron (TES) is to design tactics that the JSF will use air-to-air and air-to-ground combat. It will determine how to integrate the F-35 with other aircraft in the USAF inventory.

Working in partnership with the US Air Force Warfare Center and 422nd TES, is the USAF Weapons School 16th Weapons Squadron 'Tomahawks'. On January 15, 2015, the unit received its first F-35A, AF-60, which is used to develop

A view of AF-7 from above on its 99th test flight, the similarities in shape to Lockheed Martin's earlier F/A-22 Raptor are obvious.

F-35A test aircraft AF-6, assigned to the 461st Flight Test Squadron undertake systems development and demonstration phase of F-35 testing using six F-35As as part of a joint military, government and Lockheed Martin partnership.

Australia's first F-35A made its inaugural flight on September 29, 2014 at Fort Worth, Texas. The aircraft later flew to Luke Air Force Base, Arizona to begin testing.

On December 10, 2011 three F-35A test aircraft, AF-2, AF-3 and AF-4 flew in formation over Edwards Air Force Base to mark the completion of another stage of the test programme. AF-3 lacks the nose test probe seen on the other two aircraft.

An F-35A performs a flight test on March 28, 2013. Note the gold tint to the rear of the canopy and complete lack of a head-up display in front of the pilot.

Overseas pilots who are destined to fly the F-35 will undergo their basic training on the type at Luke Air Force Base. In additional ground crews will also be trained here, who, will later go on to instruct on F-35As back in their home nation.

The final development F-35A Lightning II stealth fighter arrived at Edwards Air Force Base on January 22, 2011 after a 3.2 hour ferry flight from Lockheed Martin's Fort Worth facility in Texas.

Snapped from the rear of a KC-135R high over the Nevada desert the pilot of the F-35A has unrivalled situational-awareness and technology at his fingertips. The Gen II Helmet-Mounted Display System visor can be clearly seen in this view.

tactics development and create the curriculum for the first F-35 course at the school, which anticipates achieving initial operational capability with the type between August and December 2016. Although one F-35A is now with the squadron, the first student course is not planned to take place until January 2018.

The first production aircraft to be used for pilot training, AF-09, was delivered to Eglin Air Force Base, Florida on July 14, 2011 to the 33rd Fighter Wing's 58th Fighter Squadron 'Mighty Gorillas'. A second operational unit to equip with the type was the 56th Fighter Wing's 61st Fighter Squadron 'Top Dogs' at Luke Air Force Base, Arizona, which received its first F-35A, AF-41, on March 10, 2014. Additional production aircraft were sent to the test units at Nellis Air Force Base.

Under the Skin and Teamwork

The patchwork appearance of the F-35's surface is due to the stealth composites used on the finish, at the time there were discussions as to applying camouflage to the airframe but the USAF quickly discounted this idea. Some debate remains as to whether the Israeli Air Force will adopt a scheme similar to its F-15I Storms when the type enters service there, but this is subject to debate. What is clear is that the USAF is now designing its aircraft with stealth in mind from the outset to counter what is believes will be a network centric air defence that will be significantly faster than aircraft faced in the Gulf Wars. For the time being the West is hedging its bets that the F-35 will still be able to oppose air defences in the late 2030s.

But flying against such defences alone will not be the tactic used by the F-35s, much like the current fleet of F-15s and F-16s the Lightning IIs will operate in packs, but it is presumed with little aerial support. Each aircraft will operate like an indigenous communications, weapons and software platform, which when required will tap into the network of sensors from other F-35s using the Multifunction Advanced Data Link. Received information will be relayed to the cockpit as a multi-sensor situational awareness picture, which will be presented to the pilot in an understandable format on the PCD.

The F-35 pilot will have information 'arriving' in the cockpit unlike anything currently flying. Not only will they be able to use satellite communication technology

'White 14' - Marseilles's Messerschmitt

Written by Lynn Ritger

We tell the story of a famous fighter pilot, his aircraft and how a recovered wreck was restored to fly once again, over the fields of Europe

Just over 75 years ago, a savage battle the likes of which the world had never seen raged above the tranquil countryside of southern England. Strapped into unimaginably powerful aircraft with more than a thousand horsepower, armed with machine guns and cannons, the men who flew them - boys, really - strained desperately to gain advantage over their adversaries, the Germans fighting to force England to surrender, and the British fighting for their very lives. Among those taking part in that titanic struggle was a young lad from Berlin named Hans-Joachim Marseille - 'Jochen' to those who knew him. He had joined his unit, I.(J)/LG 2, in early August 1940 at Calais-Marck and brought with him a well-established reputation for indifference to authority - one might even describe him as the complete antithesis to the stereotype of the stiff and humourless German soldier. Among his more notable exploits was an incident where he was participating in a cross-country flight exercise when nature called with a vengeance. He rapidly dove for the ground, quickly landed on the Autobahn, bailed out of

"Pulled from a northern Russian forest in the early 1990s, the broken hulk of a Messerschmitt Bf 109E held a remarkable surprise for the recovery team researching the history of their discovery."

the cockpit and ran for the nearest tree to answer nature's call. In the meantime, some farmers noticed the commotion and came to offer their assistance to Marseille who had already jumped back in his aircraft. As he gunned the throttle to take off, the slipstream blew the hapless Samaritans down which absolutely infuriated them. When the farmers' angry report was received at Marseille's base, he was grounded once again and soon found himself the only Oberfänrich (senior officer candidate) in his class, while the rest of his fellow classmates were granted their commissions and moved on with their careers.

His decidedly unmilitary personality aside, Marseille's skill in handling an aircraft was quickly recognised and his flying evaluations were invariably outstanding, which eventually led to his arrival on the Kanalfront on 10 August 1940, with I.(J)/LG 2, then stationed at Wevelghem in Belgium. The unit was moved to Calais-Marck right on the Channel front on 22 August, and Marseille flew his first combat mission two days later on the 24th. That first mission resulted in his first confirmed kill, but it was not an occasion to celebrate; as related in Robert Tate's 'Hans-Joachim Marseille: An Illustrated Tribute to the Luftwaffe's Star of Africa', he sent a letter to his mother that night which read, in part: "Today I shot down my first opponent. It does not sit well with me. I keep thinking how the mother of this young man must feel when she gets the news of her son's death. And I am to blame for this death. I am sad, instead of being happy about the first victory." A little over a week later, Marseille would find himself in combat once again, and this is where our story takes an interesting turn.

September 2nd, 1940 was a busy day for the pilots of I.(J)/LG 2. The nearly daily reports that the RAF was about to collapse were no longer believed by the men in the Messerschmitts; they knew better, for they faced the brave Few every day in their Hurricanes and Spitfires and the continual loss of men and machines over England and the Channel, wore heavily on them. But they had a job to do, so once again they wearily climbed aboard their Bf 109s that Monday morning; they would be flying escort for the new Bf 109E-7/b Jabos (abbreviation for Jagdbomber - fighter bomber) belonging to the II.(S)/LG 2, tasked with attacking the RAF airfields in the vicinity of London. The RAF defenders were up in force and ready for battle as usual and the Gruppen met 43 and 253 Squadron in the vicinity of Dungeness where wild fighting broke out. The Staffelkapitän of 2.(J)/LG 2, Oblt. Herbert Ihlefeld, claimed a Spitfire in this engagement at 14:25, the only victory claimed by the entire I. Gruppe in this engagement. Upon their return to Calais-Marck, the pilots were told to get ready for another mission in the late afternoon, and Marseille was once again on the mission board with his aircraft, an Arado-built Bf 109E-1 with the Werk Nummer (WNr) 3579 and coded White 14. The group headed back across the Channel on another escort mission for bombers attacking the London airfields, and Fighter Command vectored their squadrons to the Thames Estuary near Sheerness to intercept the German formations before they reached their targets.

Once again, the bone-tired defenders of the RAF pushed themselves to their limits, throwing themselves against the massive aerial armada with a determined fury and I.(J)/LG 2 was right in the thick of it. Five aircraft were claimed and confirmed by the pilots of I. Gruppe - all Spitfires of course, as aircraft recognition in the Luftwaffe seemed to have the same amusing lack of accuracy as our own modern media outlets. The Gruppe did not emerge unscathed from this scrap, however; our boy Marseille found himself in trouble after his White 14 received a heavy dose of British lead after he claimed a Spitfire over the Thames Estuary, a claim which was not to be confirmed. Like so many of his fellow Messerschmitt pilots, Marseille turned east and did his best to nurse his sick 109 back to the safety of France, knowing he might be going for a swim or worse if he failed. Luck was on his side though, and he managed to get back to Calais-Marck but for some reason either could not lower the gear, or perhaps the stress of the situation caused him to simply stick the plane on the ground via the shortest method. Whatever the case, Marseille slid White 14 down the runway on her belly and once it was hoisted up and examined, the Staffel mechanics determined the plane was literally half destroyed... they marked it down as 50% damage, which meant WNr 3579 would be disassembled, stuck on a rail car and sent back to Germany

The Kommandeur of I.(J)/LG 2 from 30 August, Hptm. Herbert Ihlefeld, would go on to command the first unit to fly the Heinkel He 162, I./JG 1 based at Leck in the spring of 1945.

to be repaired.

From here, the paths of Marseille and 3579 would diverge; Marseille wound up being transferred out of I.(J)/LG 2 as Oblt. Ihlefeld completely lost his patience with him and wound up being shuttled off to II./JG 52 where he once again infuriated the command staff. It was only when he arrived in I./JG 27 under the command of Oblt. Eduard 'Edu' Neumann that Marseille finally found an environment where he could thrive as Neumann recognised his talent and proved to be far more tolerant and accepting of Marseille's quirks. Once the unit was sent south to support Rommel's efforts in Libya and Egypt, Marseille would ascend to immortality as the 'Star of Africa' only to be killed on 30 September 1942 as he bailed out of his brand new Bf 109G-2. He was disoriented and did not realise the aircraft was in a shallow dive when he inverted it to get out of the cockpit. The tail struck him across the chest at full speed and he fell to the desert floor below, his parachute unopened.

His old Emil WNr 3579 went back to Germany for repair where it was converted to an E-7 by installing a more powerful DB 601Aa, outfitting the aircraft with wings equipped with MG-FF 'M' 20 mm cannons and installing an auxiliary fuel tank supply system. She was then dispatched to JG 77 in early 1941 where it sustained 20% damage in an emergency landing near Alakurtti, Finland on 7 December 1941. The aircraft was sent to Hannover to be repaired once again and the work was completed by April 1942. Once repaired, she was sent back to the Northern Front and was issued to 4./JG 5 where she received the code 'White 7' and became the regular aircraft of Lt. Kurt Hammel through the summer of 1942.

On 2 August 1942, Hammel in WNr 3579 joined Uffz. Willi Tretter in WNr 5559 'White 10' and another unknown pilot to escort a Henschel Hs 126 reconnaissance aircraft over the Gankachaara mountains when they encountered a formation of four Hawker Hurricane IIs and two Curtiss P-40 Tomahawks of the 760th IAP. Tretter was rammed by Sgt. Boris Mjasnikov and managed to successfully bail out of WNr 5559 but he never returned to his unit, while Hammel managed to force land WNr 3579 in a marshy area near the front lines with a dead engine and make his way back to base. Interestingly, it was only classified as 30% damaged, suggesting it would be recovered, but this never took place and WNr 3579 sat derelict and untouched for the next 49 years until she was recovered by Jim Pearce in 1991 and brought to the UK for restoration…

Our restored 109, 'White 14' in all of her glory. Magnificent!

WHITE 14 - RESTORED TO FLY AGAIN...

Having been brought back to the UK, restoration work was undertaken by Charleston Aviation Services and when she returned to the air in 1998, she became the first authentic Luftwaffe Bf 109E to take wing since the end of the war. She was sold to David Price in California not long afterwards, then purchased by Ed Russell in 2003 and moved to St. Catharines, Ontario where in April 2005, the author had the opportunity to crawl all over and inside the aircraft and helped move it outside for a full power engine test, while he assisted other members of the ground crew in holding it down. In recent years her flying has been severely curtailed owing to a dispute with a dangerously aggressive neighbour next to the St. Catharines airport who installed a tall metal pole on his property directly in the flightpath of aircraft landing and taking off; he did this knowing full well the consequences if an aircraft should strike it and indeed in June 2009 WNr 3579 struck one of these poles causing sufficient damage to declare an emergency and a forced landing in Niagara Falls. The aircraft was subsequently repaired, but has now been sold to an owner in the UK where she is currently being prepared to take part in the 2015 air show season.

My thanks go to Mark Sheppard for his tireless efforts to research the wartime history of WNr 3579, as well as Peter Cornwell, Mikael Holm, Jochen Prien, and Robert Tate for their devotion to accuracy in recording the history of Luftwaffe operations.

1. Under power, this classic fighter wants to fly! 2. Often simple in many plastic model kits, the undercarriage wells exhibit some subtle detail. 3. Fabric covers help to seal-in the walls of the wheel well. Note the simplicity of the roof. 4. The radiator matrix is an extremely simple design. Note the subtle rivet detail - barely visible and in no way a series of oversized holes! 5. The slat's mounting bracket - invisible on most models, but a neat detail nonetheless. 6. With the flap dropped away, the structure along the lower surface of the fuselage to wing joint, comes into view. 7. The edge of the drooped slat reveals its secrets… 8. The Daimler Benz engine has been beautifully restored. An engine painted in this way, would look superb inside a miniature of this restored aircraft. 9. The inside of the cockpit shows off some of its secrets. Note the wooden-trimmed wheel. 10. Cables, fuel lines and all manner of other details show off for the camera. 11. The cockpit is simply beautiful, the restoration leaving nothing to desire. 12. Smaller details provide plenty of contrasts against the overall dark grey paintwork. 13. The rear of the cockpit reveals the retaining spring and cable for the open canopy. The modern seat straps are not prototypical… 14. A final look at the inside of the restored cockpit. Use has chipped the edges very slightly to reveal the underlying yellow primer. 15. The gloss black engine block certainly helps to accent the RLM02 fixtures and fittings and the yellow trim that featured as part of 'White 14' and its colour scheme. 16. Brake lines inside the undercarriage door.

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THE HAWK THAT FOLLOWED THE GNAT…

Jonathan Mock builds the new Trumpeter Hawk T.1A

THE BRISTOL M1.C - HISTORY AND DETAIL

A wonderful full-sized replica offers modellers plenty of additional details, should they chose to build this aircraft in miniature

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In 1916, Frank Barnwell, chief designer of Bristol Aeroplane Company, realising that the performance of existing fighter aircraft was inadequate, designed a new single-seat tractor monoplane fighter as a private venture, the Bristol M.1.

The first prototype, the M.1A made its maiden flight on 14 July 1916. Constructed from wood and fabric, with a carefully streamlined, circular cross-section fuselage, this new aircraft was a futuristic design when compared to the world's biplane fighters. The wing was shoulder mounted and was braced with flying wires running from the wing to the lower fuselage, landing wires from the wings to a triangular cabane positioned over the pilot's cockpit adding further strength. A 110 horsepower (82 kW) Clerget rotary engine drove a two-bladed propeller fitted with a large hemispherical spinner to reduce drag, its size being enough to cover the entire opening of the large aluminium cowling. It was purchased by the War Office for evaluation, demonstrating impressive performance during official testing, reaching a speed of 128 miles per hour (206 km/h) and climbing to 10,000 feet (3,000 m) in 8 minutes 30 seconds,

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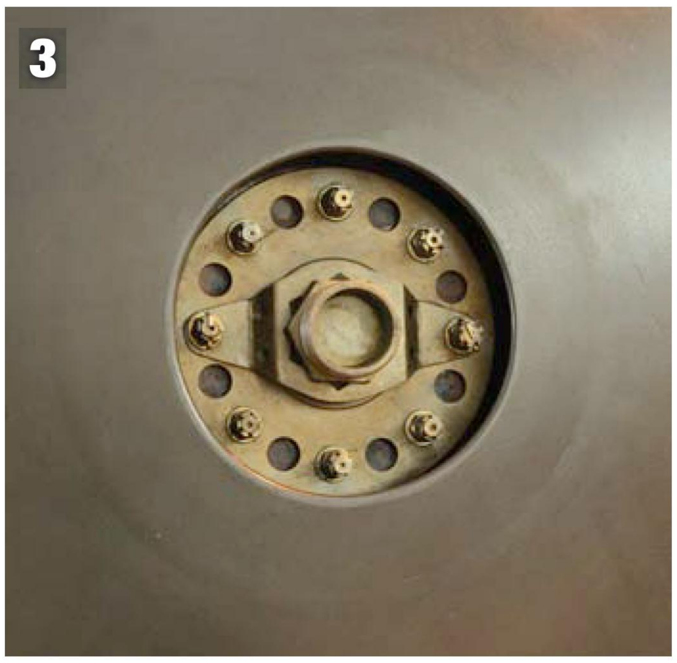
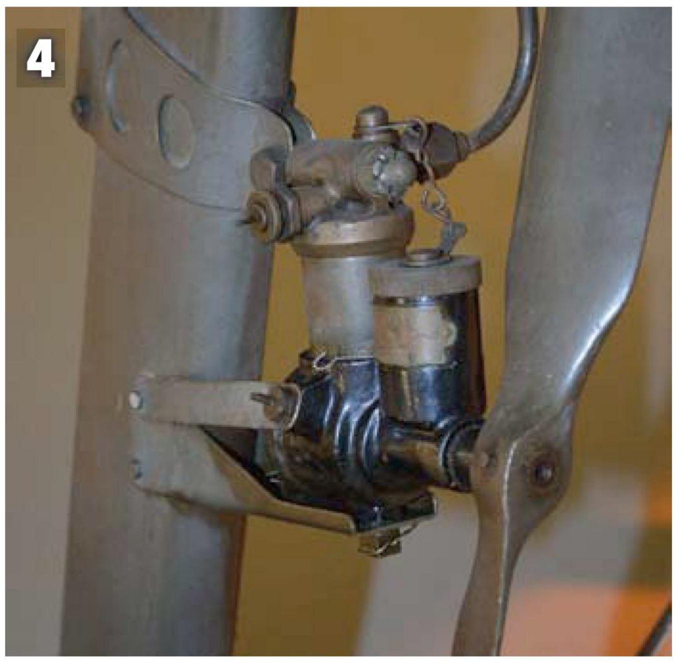
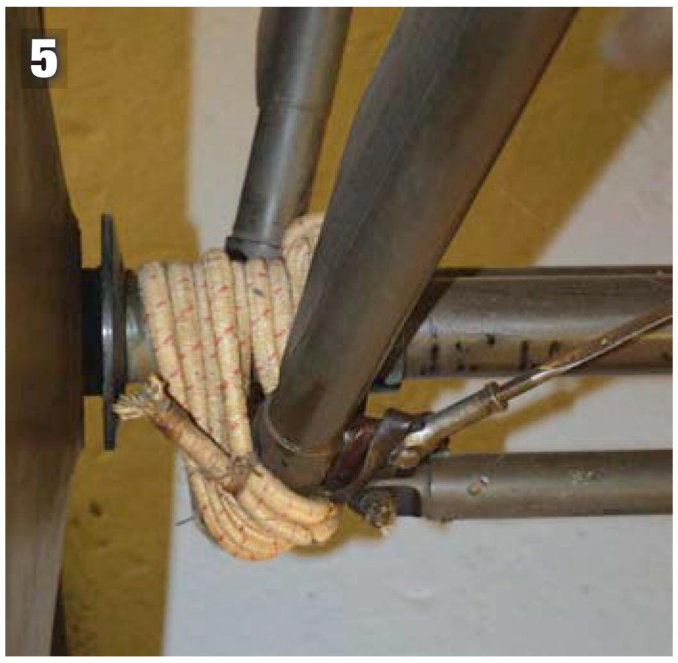
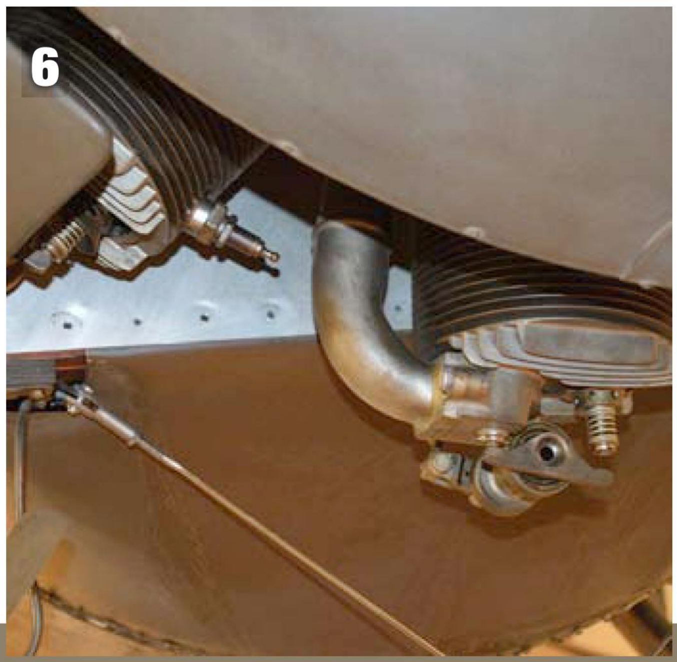
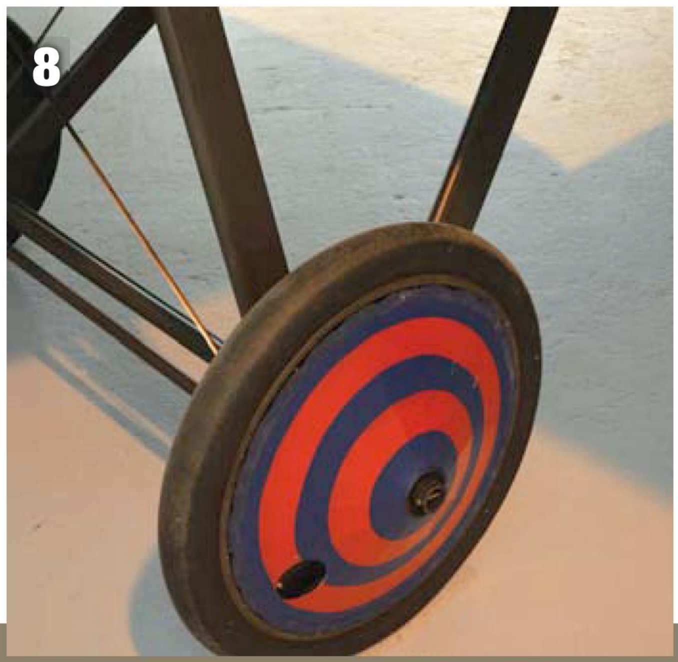










1. Cosford's replica Bristol M.1C replica looking magnificent in its 150 Squadron colours. 2. The distinctive spinner covers virtually all of the engine, giving the aircraft a wonderfully streamlined look. 3. The propellor boss seen through the opening in the cowling. Note the detail here, with that modelled by Special Hobby. 4. Generator fixed to the undercarriage leg. This is well-captured in the kit, a few bolts here and there and a power cable, being the only necessary additions. 5. Bungee cord detail at the base of the undercarriage. Once again, small details such as bolts and the rigging brackets, come into view. 6. With the spinner in place, this is virtually all you can see of the Le Rhone engine… 7. The kit's undercarriage is highly simplified and could certainly do with some adjustment and extra detail. Here, you can see how it fixes to the fuselage, as well as the brackets holding the cowling and rigging wires in place. 8. The red and blue wheel hubs certainly add a splash of colour! 9. Tail features. Note the rib details and variation in thickness of the bracing wires and control lines. 10. Simple hinges join the rudder to the fin. Note appearance of control horn and mounts for flying wires. 11. The later cabane layout, that was standard on production M.1Cs. Note the windscreen style on this replica aircraft. 12. The edges of the cockpit opening are protected with this stitched leather panel. Note screw detail. 13. Cockpit detail reveals a myriad colours, textures and small features. 14. Highly simplified in the kit, this is how the cabane joins the fuselage structure.

although the forward and downward view was criticised by test pilots, who must also have struggled to both access and exit the tiny cockpit covered as it was, by those intrusive cabane struts.

The War Office ordered four modified aircraft, designated M.1B, in October 1916. These differed from the first prototype in having a more conventional cabane consisting of a pyramid of four straight steel struts, a large clear-view cut-out panel in the starboard wing root to give improved view for landing and a single .303 in (7.7 mm) Vickers machine gun mounted on the port wing root.

Despite excellent performance — it had a maximum speed some 30-50 mph (50–80 km/h) higher than any of the contemporary German Fokker Eindecker and French Morane-Saulnier N monoplanes — it was rejected by the Air Ministry for service on the Western Front, ostensibly because its landing speed of 49 mph was considered too high for small French airfields. More likely, the rejection was because of a widespread belief that monoplane aircraft were inherently unsafe in combat. The RFC had imposed a ban on monoplanes after the crash of one of the Bristol-Coanda Monoplanes on the 10th of September 1912, and despite the subsequent 1913 Monoplane Committee clearing the design type, there persisted a deep-rooted suspicion of monoplanes. This suspicion may also have been reinforced by the RFC's underwhelming experience with various Morane-Saulnier monoplanes, especially the Morane-Saulnier N, which was also criticised for its high landing speed.

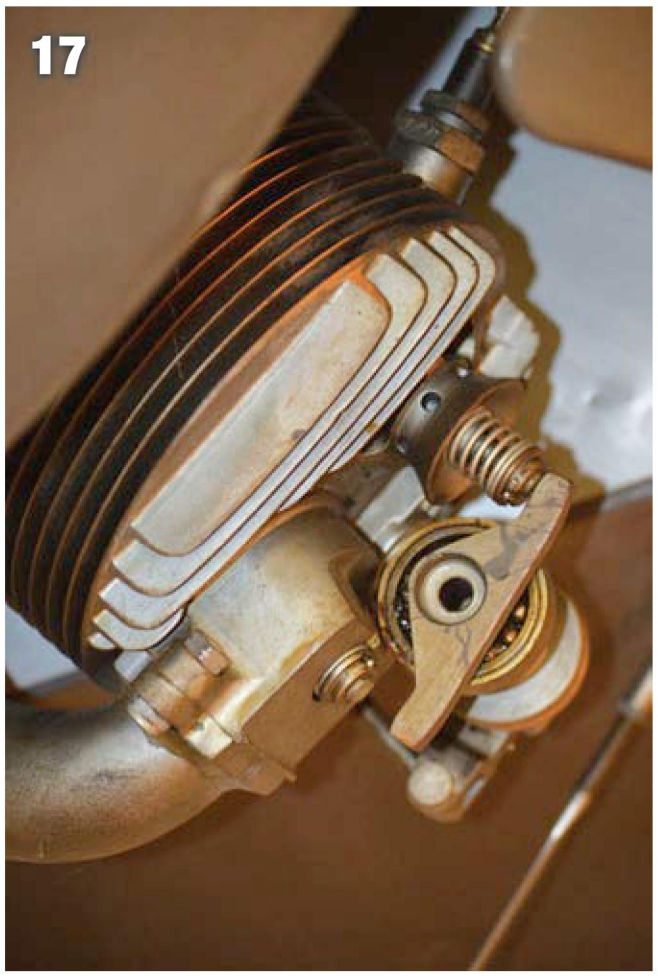
Nevertheless, a production order for 125 aircraft was placed on 3 August 1917. Designated M.1C, this version was fitted with a Le Rhône rotary engine and had a Vickers machine gun mounted centrally in front of the pilot.

A single M.1, registered G-EAVP was rebuilt as a high-speed testbed for the Bristol Lucifer three cylinder radial engine. This aircraft was designated the M.1D.

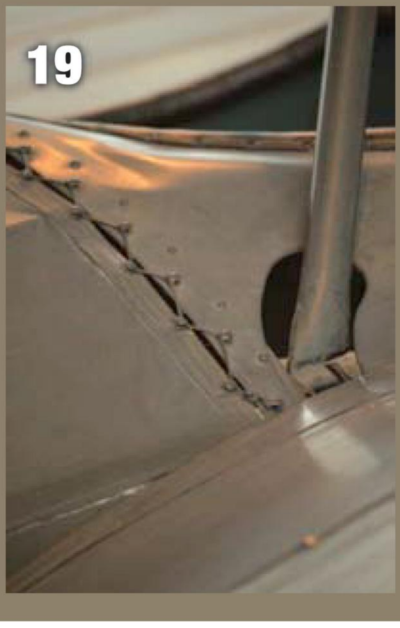
Operational history

33 M.1Cs served in the Middle East and the Balkans in 1917–18, while the rest were used by UK-based training units, where they were popular as personal mounts for senior officers.

One pilots of the M.1Cs that served on the Macedonian Front was Captain Frederick



15. The neat little fuel gauge.
16. Wheel hub detail. This pin can be added easily to the kit parts.
17. The Le Rhone engine reveals some of its secrets. Note colour.
18. This clear panel is understandably missing from the kit's one-piece wings - maybe another detail to add?
19. The rear fuselage's fabric is joined to the upper fuselage panels with some very neat stitching.
20. Tailskid detail. Wood and metal construction is noteworthy.



Dudley Travers DFC of No. 150 Squadron RAF, the only ace on this type. Travers switched from the Royal Aircraft Factory SE.5a, in which he had scored three of his four kills and scored the last five of his victories between 2 and 16 September 1918, possibly all in the M.1C serial number C4976. Amongst his victims was a Fokker D.VII, widely regarded as the best German fighter of its day.

Twelve were sent to Chile on second half of 1918 in part payment for the battleships Almirante Latorre and Almirante Cochrane being built for Chile in Britain but commandeered for the Royal Navy before completion. One of these, flown by Lt. Dagoberto Godoy, was used to fly from Santiago to Mendoza, Argentina and back on 12 December 1918, the first flight across the Andes mountain chain.

The Lucifer engined M.1D, painted red and registered G-EAVP, was successfully raced during 1922, winning the handicap prize in the 1922 Aerial Derby, piloted by L.L. Carter.[9] The next year it was fitted with a specially tuned 140 hp (100 kW) Lucifer and entered for the Grosvenor Cup, during which it is crashed at Chertsey on approach to Croydon Airport, killing the pilot, Ernest Leslie Foot.

There are a number of Bristol M.1s around that we can enjoy, some of which, like the one we see here, being high quality replicas of this pugnacious monoplane. Though it's difficult to be sure that all of the details are prototypically perfect, seeing a full-size aircraft such as this gives the modeller a very good idea of how they looked in service, the details that would have been apparent and the finish and markings in which they would have appeared. Hopefully you will find this little walkround useful and it will provide you with some additional details that you can add to your model.

BRISTOL M.1C (REPRODUCTION) C4994/G-BLWM

The aircraft seen at the museum was built between 1983 and 1987 by Don Cashmore at his Nottinghamshire workshop using original manufacturers' drawings and diagrams. During assembly, it was fitted with a non-standard 165hp Warner Scarab 7 cylinder radial engine, ready for the registration G-BLWM to be issued, construction being almost complete by the end of 1986.

The first flight of this replica M.1C took place on Sunday the 21st of June 1987 by Rolls-Royce test and display pilot John Lewis. Flying from Hucknall airfield near Nottingham, he made at least two further flights of 20 minutes and 30 minutes duration respectively. Flown with the serial number C4912 - which originally belonged to an M.1C serving with No.150 Squadron at Salonika in 1918 - it was retired soon after this and Scarab engine removed, before being sold to the RAF Museum (Don

Cashmore had always intended to test fly the aircraft and then dispose of it).

During February of 1988, the aircraft was sent RAF Museum RC&RC Cardington for rework, where it was fitted with an original 110hp Le Rhone rotary engine from Museum stock and given the serial and Red Dragon insignia of an instructor flying RFC Training School aircraft C4994 in 1917-1889 — the colours that you see it in today.

HAWKS OVER THE YEARS

We take a look at some of the varied colour schemes that the Hawk has carried in RAF and RN service

Written By Alan Firbank

1. XX310 at an RAF Waddington Photocall in May 1990. The markings are CFS, RAF Valley. The red, white, blue and grey scheme is one of the most appealing and makes an attractive model.

2. In recent years the RAF's Hawk Display aircraft and commemorative schemes have been spectacular, many incorporating the Union Jack. This Hawk celebrates the 50th anniversary of No. 4 Flying Training School as seen at RIAT Fairford July 2010

When asked to produce a feature on the Hawk, several hours were spent browsing through binders full of 35 mm slides and how the memories came flooding back! Hawks are regularly used to celebrate various squadron anniversaries but have some of their own to celebrate currently. August 21st 2014 was the 40th anniversary of the Hawk's first flight and next November 2016 will be the 40th anniversary of the first T1s being delivered to the RAF. Those who take notice of serial numbers will see Hawks dating back to 1977 and 1978 when most of the production run was being delivered, the final deliveries being made in 1982. Many Hawk T1As are older than their pilots being 33 to 40 years old! This is a glowing tribute to the quality of the aircraft and the crews who have kept them flying over the years.

As far as modelling is concerned, the Hawk offers a host of markings opportunities, from the early schemes to the present day. Unlike many military jets, it has not changed from the early days until now, as it bows out of service. T1As are being withdrawn from service as T2s are delivered but the newer variant is quite a different aircraft, inside and out. Hawk T1 kits in all the popular scales can be used to make models in any scheme, without having to resort to additions and modifications. Decal sheets for the type readily available for models of all ages. We hope you enjoy a look back at Hawk schemes from the distant past and some more recent examples. Look out for the RAF's 2015 Hawk display aircraft that will be a T2 for the first time this air show season. ●

3. XX230 was amongst the first Hawks to be given a coat of overall gloss black that was initially used on the Hawk Display aircraft. The markings on XX230 are No. 63 (Shadow) Squadron as seen on take off from the International Air Tattoo at Boscombe Down in June 1992. 4. Ground attack training Hawks were based at RAF Brawdy in South Wales and RAF Chivenor, North Devon with the Tactical Weapons Units. Most of their Hawks were painted in a wraparound scheme of Dark Green and Dark Sea Grey. XX325 in No. 151 Squadron colours is seen here taxing at RAF Finningley in September 1989.

5. XX261, one of the Hawks marked to celebrate 100 years of Royal Navy Aviation departs RAF Fairford's RIAT 2009.

6. This Hawk, XX318 from No. 1 Tactical Weapons Unit is displaying markings to celebrate the 75th Anniversary of No. 234 Squadron, as seen at Boscombe Down's IAT, June 1992. 7. XX285 in No. 151 Squadron markings at RAF Finningley, September 1989 with some interesting weathering patterns showing on the Dark Sea Grey. 8. No. 100 Squadron has operated Hawks in a support role as target tugs, etc for many years, based at RAF Leeming in North Yorkshire. XX312 in special display markings is seen here departing Boscombe Down in June 1992. 9. This must be one of the prettiest standard Hawk scheme from RAF Valley in the markings of the No. 4 Flying Training School seen at Boscombe Down 1992. 10. XX331 in Tactical Weapons Unit Dark Green and Dark Sea Grey at Greenham Common in July 1983. 11. XX159 in the colours of No. 4 Flying Training School with markings commemorating 1,000,000 UK Hawk flying hours at RIAT Fairford in 2006. One million flying hours is a staggering amount and that was several years ago. 12. Last year, the Red Arrows celebrated their 50th display season with special tail markings with small Gnats and Hawks incorporated into the Union flag. Here XX244 taxis along the runway at Fairford during RIAT 2014. 13. XX188 is one of the oldest Hawks, still going strong in 100 Squadron markings at RIAT 2006. 14. The Royal Navy celebrated 100 years of flight in 2009. XX261, one of four Hawks marked to celebrate the Centenary, rolls out on Fairford's runway at RIAT. 15. This Hawk in Royal Navy markings appeared at RIAT in 2006. It is caught leaving Fairford's runway going in a more unusual easterly direction. These Hawks are used to simulate attacks on Royal Navy ships. 16. Another old Hawk (XX184) painted Dark Earth and Dark Green to celebrate the 70th anniversary of the delivery of the first Spirfires to No. 19 Squadron at RAF Duxford in 1938. The Hawk is shown here at RIAT in July 2008 carrying a 30mm Aden gun pod on the centreline pylon.

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AVAILABLE IN GOOD MODEL SHOPS
HK MODELS
Mosquito B Mk IV, PR Mk I/IV
GO TO HELL
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NEW!!

REFERENCE FEATURE

The Airbus A320

We take a look at the A320 in service around the world

Written By Marcus Jellyman

1: Airbus Industries F-WWBA: F-WWBA Airbus A320-111 msn:0001 of Airbus Industries. On the 27th February 1987 this aircraft made the maiden flight of the A320 and is still going strong as a test aircraft, some 28 years later. Here she is seen testing Airbus' Sharklet winglets at its home base of Toulouse Blagnac in the South of France.

2: Easyjet G-EZUI 200th: G-EZUI Airbus A320-214 of Easyjet. The aircraft was painted in this special 'inverted' colour scheme to represent the 200th Airbus to be delivered to Easyjet. They have just taken delivery of their 250th Airbus, which has again been marked by a special colour scheme.

Since its first flight in 1987 the A320 series of aircraft have set the standard for commercial aircraft in terms of design and technology. Throughout the years it has ranked as the world's fastest selling aircraft and is currently the best-selling airliner with over 6,500 delivered and around another 5000 still on its order books.

The manufacture of the A320 is truly a European wide effort with sections of aircraft being built in numerous countries across Europe and shipped to either Toulouse in southern France, or Hamburg in Germany for final assembly. In September 2008 a third assembly line was opened in Tianjin China to cope with the high demand for aircraft in the country.

Development

Following on from the successes of its A300 and the A310 wide bodied airliners, Airbus had high hopes for its new smaller A320 design that it would equal the sales success of its big brothers. An initial announcement for the launch of the A320 was made way back in February 1981, but it wasn't until 1984 that a final design for the aircraft had been finalised. During these three years every aspect of the aircraft had been looked at and vast improvements made over its rivals. The new wing was long and slender and had superior aero dynamic efficiency over its nearest rivals, improving fuel consumption and speed. The diameter of the fuselage was also greater which made for a larger cabin, offering a wider centre aisle and larger more comfortable seating for passengers.

The greatest leaps forward in terms of design however, were the 'state-of-the-art' avionics. Every aspect of the design was revolutionary, making the A320 more advanced than anything in the air at the time. Everything in the cockpit is digital with numerous computers controlling the aircrafts parameters via the fly-by-wire system. The computers are programmed to know the safe flight envelope and will not let any part of it to be exceeded. Another feature not see on large commercial aircraft before was the location of the yoke. A new small side stick

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3: Citilink PK-GLY: PK-GLY Airbus A320-214SL of Citilink Express. Citilink Express is the low cost arm of Indonesia's main airline, Garuda. It is a Sharklet equipped aircraft, and is seen here in the early evening about to start its long delivery flight from Toulouse to Indonesia.

4: Iberia EC-IZH: EC-IZH Airbus A320-214 seen departing Madrid Barajas in the classic colours of the Spanish national carrier, Iberia.

5: British Airways G-BUSC: G-BUSC Airbus A320-111 was one of only a handful of 100 series aircraft to be produced. The aircraft was number 8 of the production line and served with British Airways for only 20 years before being scrapped. It is seen here departing London Heathrow in a special colour scheme supporting the GB Olympic team during the Syndey 2000 Olympics.

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controller was favoured over the traditional yoke in the centre, allowing for large flight display screens to be placed directly in front of the crew. These screens can switched to display any information the pilots require, reducing the amount of instruments from around 40 in similar aircraft, to just 12. Any faults that occur during the flight are also monitored by the computers and if significant will inform the crew. Once on the ground maintenance engineers can then get a detailed printout of every system on the aircraft and any faults that have occurred.

The first A320 was rolled out at Toulouse on the 14th February 1987 and first flew eight days later on the 22nd February. Certification was gained within a year and first deliveries began to British Airways, Air France and France's Air Inter began. These initial deliveries were A320-100's of which only 21 were produced, and can be recognised as having no wing tip fences. All other deliveries since have been the 200 series. Only one choice of engine manufacturer was available at the time of the launch, with

Lauda OE-LBR: OE-LBR Airbus A320-214 in the colours of Austrian carrier Lauda Air. It is seen here arriving on the beautiful Greek Island of Corfu.

the CFM56. The IAE V2500 was offered soon after and was a collaboration of several large aero engine manufacturers including, Rolls Royce and Pratt & Whitney. Both have the same power rating with the V2500 being slightly more efficient. Several derivatives of the A320 have been produced, the first being the stretched A321 which is 6.94 metres longer than the A320. Next was the A319, a slightly shortened version of the A320 (3.73 metres), and finally the baby of the series, the A318 (6.12 metres shorter). All three derivatives are built in Hamburg, Germany.

A320 Enhanced CEO & NEO family

In 2006 Airbus began research and development into improvements to the A320 family. They included improvements to the aerodynamics, engines and cabin. The most noticeable of these was the addition of large winglets (Airbus name Sharklets). These modifications would increase either payload of the aircraft or add an additional 100 nautical miles range. Known as the A320ceo (Current engine option) deliveries of these aircraft began in December 2012. The future for the A320 is the NEO (New engine option). Two brand new engines options have been developed, and with new interior layout, will provide airlines with a further 20 per cent improvement in fuel consumption and an extra 500 nautical miles range. The first aircraft flew in September 2014 and deliveries are due to commence by the end of 2015.

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7: Afriqiyah Airways TS-INA: TS-INA Airbus A320-214 of Nouvelair Tunisia on lease to Afriqiyah Airways of Libya. The interesting colour scheme is reference to the date 9th September 1999. This was the date of the establishment of the African Union in Sirte which Libya supported. The aircraft is seen here arriving at London Gatwick on a cold December morning in 2007. 8: TAP Air Portugal CS-TNK: CS-TNK Airbus A320-214 of TAP Air Portugal arriving at London Gatwick with a service from Lisbon. 9: Jetstar Airways 9V-JSD: 9V-JSD Airbus A320-232 msn:2401 of Jetstar Asia Airways. Delivered to the airline in early 2005, and returned to its lessor in 2013. Now operating with THY Turkish Airlines. Seen here arriving back at her home base of Singapore Changi in 2006.

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Mirage mon amour!
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BELL UH-1Y 'VENOM'

A SUPER HUEY FOR THE 21ST CENTURY

The legendary Bell UH-1 made better, that's the Bell UH-1Y. It has all the effectiveness, safety and reliability of the original the original design but with all of the modern upgrades needed for the twenty-first century.

By Model Airplane International

1

1: Bell UH-1Y during sea trials aboard USS Bataan (USMC Image)

2: U.S. Marine Corps pilot from Marine Light Attack Helicopter Training Squadron 303, Marine Aircraft Group 39, 3rd Marine Aircraft Wing, prepare to land a UH-1Y Huey belonging to the squadron, during confined area landing training at Marine Corps Base Camp Pendleton, California (USA), 28 August 2008. The squadron was the first in the U.S. Marine Corps to train air crew and maintainers for the UH-1Y. (USMC Image)

The Bell UH-1Y Venom (also called the Super Huey) is a twin-engine medium size utility helicopter, part of the United States Marine Corps' H-1 upgrade program. The helicopter is also called Yankee for its variant letter, Y. It is currently in full-rate production to replace the USMC's ageing fleet of UH-1N Twin Huey light utility helicopters first introduced in the early 1970s. The UH-1Y was to have been remanufactured from UH-1Ns, but in 2005 it was approved for the aircraft to be built as new.

Over the years new avionics and radios - in addition to modern door guns and safety upgrades - had greatly increased the UH-1N's empty weight. With a maximum speed of approximately 100 knots (190 km/h) and an inability to lift much more than its own crew, fuel and ammunition, the UH-1N, while useful, was limited in use around the battlefield, so during 1996, the United States Marine Corps launched the aforementioned 'H-1' upgrade program, signing a contract with Bell Helicopters to convert 100 UH-1Ns into UH-1Ys and 180 AH-1Ws, into AH-1Zs.

The 'H-1 Program' created, completely modernised these attack and utility helicopters, considerable design commonality helping immeasurably to reduce operating costs. For instance, the UH-1Y and AH-1Z share a common tail boom, engines, rotor system, drive train, avionics, software, controls and displays, with over 84% identical components across both helicopters.

Like its predecessor, the Super Huey operates in the most extreme of battlefield environments, from Arctic cold to desert heat and as such, incorporates the latest aerospace technology: airframe improvements, twin General Electric T700 engines, an ultramodern glass cockpit and many more advanced systems to get the job done. The Yankee-model also features upgraded avionics, a glass cockpit, safety modifications and a modern FLIR system. The biggest improvement though is an increase in engine power; by replacing the engines and the two bladed rotor system with four composite blades, the -1Y returns the Huey to the utility role for which it was designed.

2

3: U. S. Marine Corps UH-1Y Venom helicopter with Marine Heavy Helicopter Squadron (HMH) 466, Marine Aircraft Group 16, 3rd Marine Aircraft Wing, refuels during Operation Desert Tantrum (USMC Image)

4: A U.S. Marine Corps UH-1Y Venom helicopter (top) of Marine Light Attack Helicopter Squadron 369 (HMLA-369) returns after aiding a U.S. Army HH-60M Blackhawk medical evacuation (medevac) helicopter, Afghanistan, Dec. 9, 2011. HMLA-369 provides close air support for medevacs and ground units conducting combat operations throughout the Helmand Province. (USMC Image)

Features

- 125% higher payload than the UH-1N
- Almost 50% more range and maximum cruise speed than the UH-1N
- Sustainable high G loads in tactical or evasive manoeuvres.
- Reduced vibration
- Fully integrated, night vision goggle (NVG) compatible "glass" cockpit
- Advanced electronic warfare self protection (EWSP) suite, and ballistically hardened components protect it from a broad range of modern threat weapons.
- A proven crashworthy fuel system to reduce the risk of fire and fully stroking energy attenuating seats to protect crew members and passengers from injury, in the event of a crash.

The Y-model updates an airframe that has been central to the Marine Corps aviation in Iraq. The Huey has many mission requirements including command and control, escort, reconnaissance, troop transport, medical evacuation and close air support. Typically detachments of 2–4 Hueys have been deployed with detachments of 4–8 Cobras. The forward mounted weaponry of the Cobra combined with the door guns of the Huey provides a 240° field of fire.

Bell delivered two UH-1Ys to the US Marine Corps in February 2008. As of September 2009, the UH-1Y was in full-rate production, with the Marine Corps receiving 21 by the end of the year, 160 being planned for delivery by the end of 2016.

The Lockheed Martin target sight system (TSS) incorporates a third-generation forward looking infrared (FLIR) sensor. The TSS provides target sighting in day, night or adverse weather conditions. The system has various view modes and can track with FLIR or by TV. It is also used on the Bell AH-1Z Viper and the KC-130J Harvest HAWK.

Like no other utility helicopter in the world, the UH-1Y survives combat with an advanced countermeasure suite, which includes:

- AVR-2A Laser Warning Receiver
- APR-39A(v) 2 Radar Warning Receiver
- ALE-47 'Smart' Countermeasures Dispenser and
- AAR-47 Missile Warning Device.
- Energy attenuating crashworthy seats
- Energy-absorbing landing gear
- Self sealing fuel tanks and fuel systems

Operational history

The UH-1Y and AH-1Z completed their developmental testing in early 2006. During the first quarter of 2006 the UH-1Ys were transferred to the Operational Test Unit at the NAS Patuxent River, where they began operational evaluation (OPEVAL) testing. In February 2008, the UH-1Y and AH-1Z began the second and final portion of OPEVAL testing.

On 8 August 2008, the Marine Corps certified the UH-1Y as operationally capable and was deployed for the first time in January 2009 as part of the aviation combat element of the 13th Marine Expeditionary Unit. The UH-1N Twin Huey was retired by the Marines in August 2014, making the UH-1Y the Marine Corps' standard utility helicopter.

(Information via USMC, Bell Helicopters and Wikipedia)

REFERENCE FEATURE

General characteristics

- Crew: One or two pilots, plus crew chief, other crew members as mission requires
- Capacity: 6,660 lb (3,020 kg) including up to 10 crashworthy passenger seats, 6 litters or equivalent cargo[35]
- Length: 58 ft 4 in (17.78 m)
- Rotor diameter: 48 ft 10 in (14.88 m)
- Height: 14 ft 7 in (4.5 m)
- Disc area: 1,808 ft² (168.0 m²)
- Empty weight: 11,840 lb (5,370 kg)
- Useful load: 6,660 lb (3,020 kg)
- Max. takeoff weight: 18,500 lb (8,390 kg)
- Powerplant: 2 × General Electric T700-GE-401C turboshaft, 1,828 shp for 2.5 min; 1,546 shaft horsepower continuous (1,360 kW for 2.5 min; 1,150 kW continuous) each

Performance

- Never exceed speed: 198 kn (227 mph, 366 km/h)
- Maximum speed: 164 knots (189 mph, 304 km/h) for 30 minutes
- Cruise speed: 158 knots, 182 mph, 293 km/h (long range cruise (LRC): 135 kn, 155 mph, 250 km/h)
- Combat radius: 130 nautical miles (150 mi, 241 km) with 2,182 lb, 990 kg payload
- Endurance: 3.3 hours
- Service ceiling: 20,000+ ft (6,100+ m)
- Rate of climb: 2,520 ft/min (12.8 m/s)

Armament

- 2 external stations for 70 mm (2.75 in) Hydra 70 or APKWS II[36] rockets
- 2 pintle mounts for 7.62 mm M240D machine guns, .50 BMG GAU-16/A machine guns, or 7.62 mm GAU-17/A Gatling guns

5: This UH-1Y arrives safely onto the forward flight deck of the amphibious assault ship, USS Boxer (LHD 4). (USMC Image)
6: A UH-1Y Huey helicopter takes off from the amphibious assault ship USS Wasp (LHD 1). (US Navy Image)

In order to ring the emotional bell even more, the Vulcan and Red Arrows flew this perfect formation. Truly a sight to behold!

We visit

THE ROYAL INTERNATIONAL AIR TATTOO 2015

WRITTEN BY SPENCER POLLARD WITH FLYING IMAGES FROM ALAN FIRBANK

The star of any airshow, Avro Vulcan XH558 is put through her paces at this, her final, International Air Tattoo.

Arguably the biggest and most famous air show in the world, the Royal International Air Tattoo was once again held in July of this year, 100,000 excited visitors making the trip to Gloucestershire to enjoy the flying displays and collection of aircraft found in the static park. “Securing the Skies - Past, Present and Future” was the theme for this year’s Royal International Air Tattoo. We’ll let the organisers explain what they had in mind for this year’s excellent event.

“When it comes to Securing the Skies and ensuring the safety of its citizens, the UK has always relied predominantly on the skill and professionalism of the men and women who serve in the Royal Air Force.

Whether countering increasingly sophisticated and diverse military threats or delivering humanitarian assistance and disaster relief, Securing the Skies and demonstrating Air Power is critical at home and around the globe.

Today, thanks to cutting-edge platforms operated by highly skilled personnel, the

The USAF brought along two CV-22B Ospreys from the 7th Special Operations Squadron of the 352nd Special Operations Wing at RAF Mildenhall, Suffolk. One of the highlights of the show, this spectacular aircraft performed with power and grace as part of the flying display.

RAF is capable of controlling airspace, providing timely and accurate intelligence and mobilising quickly and effectively to meet a wide range of missions.

The same is true of those air arms operating alongside the RAF, and in 2015 the Royal International Air Tattoo will be inviting them to RAF Fairford to help highlight how Securing the Skies is achieved across the world.

On the 75th anniversary of the Battle of Britain, the spotlight will fall on this historic aerial conflict, the bravery of the pilots from 14 nations who flew with RAF Fighter Command and the contribution new technology such as radar then played in Securing the Skies.

From the Supermarine Spitfires and Hawker Hurricanes of yesteryear to the Typhoons of today and the Lightning IIs of tomorrow, the RAF, often operating alongside its NATO allies or coalition forces, is committed to providing frontline protection from aerial threats.

Among the most distinctive shapes in the static display was the North American OV-10B Bronco, provided by Tony de Bruyn and the Bronco Demo Team from Wevelgem, Belgium. This aircraft was utterly immaculate!

The Greek Airforce sent over ‘Zeus’, one of their Block 52+ F-16 Fighting Falcons from the 115th Combat Wing at Souda.

Just look at that colour scheme! Stunning!

This glorious Spitfire LFIXE, looking very smart in its post-war Czech markings.

The Finnish Air Force’s F/A-18C and D Hornet fleet is divided between Lapland and Karelia Air Commands, where they equip Fighter Squadrons 11 and 31 respectively. There is something about these plain F-18s that makes them look very attractive…

Pilatus PC-9M of the Slovenian Air Force, stationed at Cerklje ob Krki in the south-east of the country. Known as the Hudournik (Swift) in Slovenian service, it is used both as a trainer and as a light attack aircraft.

SHOWTIME

This specially painted Czech Hind replicated the scheme found on wartime B-24 Liberators.

Another fine inclusion in the static display was this Polish Mil Mi-14 'Haze'. Once again, the finish was almost perfect.

Mastery of the aerial battlespace remains as important today as it was in 1940 and on 17-19 July 2015 the Air Tattoo will highlight the crucial role that aircraft play in Securing the Skies.

In support, highly trained RAF servicemen and women perform a wide range of specialist roles, from armourers, technicians and aerospace battle managers to chefs, medics and firefighters, all contributing towards the effectiveness of the Royal Air Force.

Whenever Air Power has been needed, the RAF has demonstrated it is capable of responding at a moment's notice, 24 hours a day, 365 days a year, Securing the Skies and making us safe - past, present and future."

Over the next few pages we make no apology for bringing you some of the highlights from RIAT 2015. Picking the shots to use was no easy matter. Though personal preference played a part to some degree, our first choice had to be what was to many the star of the show, the beautiful Kawasaki P-1. For the first time the Japanese Air Self Defence Force featured as part of the flying display, one of these amazing-looking anti-submarine patrol aircraft wowing the crowds over the weekend, whilst another could be seen as part of the static display. In all honesty I'm struggling to think of a more beautiful aircraft! I was not only stunned by its sweeping lines, but up close the build and colours of this aircraft had to be seen to be believed, its pale blue plumage looking simply gorgeous both on the ground and in the air…

But of course there were other highlights! Seeing a Mil-24 Hind in the air was a treat, as was the sight of the smoky, loud and still incredibly manoeuvrable MiG-29 Fulcrum. Having only seen this aircraft a handful of times over the years, it was amazing to see how this analogue fighter could be thrown around the sky, brute force and no shortage of

"Seeing a Mil-24 Hind in the air was a treat, as was the sight of the smoky, loud and still incredibly manoeuvrable MiG-29 Fulcrum"

The Textron AirLand Scorpion made its world public debut at RIAT 2014 and returned again this year.

How well timed was this shot?!

The Airbus A400M leaves the runway at the start of what was to be a very spritely display…

power, helping to keep it turning and burning throughout its display. Superb.

Though the American services were in shorter supply than in previous years, they still managed to thrill visitors to Fairford with not only a static display that included two A-10C Thunderbolts, but also two CV-22B Ospreys from the 7th Special Operations Squadron of the 352nd Special Operations Wing at RAF Mildenhall, Suffolk. Though plagued with teething problems during its early years of development, this aircraft has grown into a very special machine, combining all of the attributes of a helicopter with the power and speed of a conventional aircraft. Seeing such a huge aircraft dance around the sky was a sight to behold, seeing it power away at the end, something else altogether. The last time we witnessed that amount of acceleration, it was from a Harrier and we all know how highly those aircraft are regarded in these parts…

Seeing a wonderfully restored Bristol Blenheim in the air was an evocative moment within this year's flying display.

One of many Spitfires to be seen in the air over the weekend, Spitfire P7350 is the oldest airworthy Spitfire in the world and the only Spitfire still flying to have actually fought in the Battle of Britain.

Wattisham's 3 Regiment provided the Apache display for 2015, which had been increased from a solo aircraft to a two-ship team, accompanied once again by spectacular pyrotechnics as part of an operational-type scenario.

Carrying a 100th Anniversary tail, this IV(R) Squadron Hawk was an attractive performer.

A true Cold-War warrior, the Hind is still very a malevolent sight.

The editor's personal favourite at this year's event, the simply stunning Kawasaki P-1. It's hard to believe that this is a warplane…

SHOWTIME

Overflying the crowd, the Kawasaki P-1 opens its weapons bay to reveal its secrets…

If I were to pick a personal highlight, it would have to be the sight and sound of the two French AF Mirage 2000Ns powering down the runway to begin what was to be a display that didn't really go according to plan. Having blasted off, the two Mirages ringed the airfield only for one of them to ingest a bird and have to immediately land as the other flew alongside. Two became one, as what was originally a two-aircraft display became a solo outing - but what a display! Though from an older generation of fighters, the Mirage 2000 is still utterly mesmerising in the air, speed, grace and incredible levels of manoeuvrability helping to create an unforgettable performance.

Of course the same could be said for the Greek AF's participation. Political and financial troubles aside, the appearance of their specially painted F-16 Block 52+ Fighting Falcon was another to savour. Taking away the

"The last time we witnessed that amount of acceleration, it was from a Harrier and we all know how highly those aircraft are regarded in these parts…"

This Mirage 2000N was flown as part of the Ramex Delta tactical display, one of the French Air Force's numerous demonstration teams. The Ramex Delta team comes from Escadron de Chasse 2/4, the famous 'Escadrille Lafayette' of First World War fame.

Clean as a whistle, the rare Spanish AF SF-5M was seen as part of the static display over the weekend. Here it is lifting off from Fairford's enormous runway.

Though only a small change, the new Red Arrows scheme looks very smart.

The perfect photo opportunity!

Lift off! The Polish MiG-29 at RIAT 2015 hailed from the 23rd Tactical Air Base at Mi sk Mazowiecki in eastern Poland.

It won't be long before Tornados are a thing of the past, their retirement from NATO service being just around the corner…

F-15C Eagle. The sole examples of this aircraft stationed in Europe, are on the strength of the 493rd Fighter Squadron 'Grim Reapers', part of the RAF Lakenheath-based 48th Fighter Wing, this one being a fine example.

beautiful 'Zeus' scheme in which this aircraft had been painted, the display showed us all what this upgraded Falcon could do and why, almost 40 years after its first flight, the F-16 is so highly regarded around the world.

Though my personal preferences will always be the jets, there can be no denying that the celebration of the 75th Anniversary of the Battle of Britain was both moving and wonderfully choreographed. The sight of so many aircraft from that period such as Spitfires, Hurricanes, Messerschmitt Me109s and memorably, a Blenheim, was something that will stay with me for many years to come. Flown against skies that only a few minutes earlier were grey and dank, but were now pastel blue and bright, these aircraft looked and sounded utterly beguiling. Looking back now, it seemed like the perfect way to remember those dark days of 1940, with all combatants being remembered thanks to aircraft that were flown by nations other than Britain, Germany included.

So this then is our roundup of that weekend in July. We hope you enjoy seeing these pictures as much as we enjoyed being there in person. I would like to take this opportunity to thank my friend and longtime collaborator Alan Firbank who's superb flying shots grace this feature. Cheers Alan! ●

Two A-10Cs from the 354th Expeditionary Fighter Squadron, a unit normally based at Davis Monthan Air Force Base, Arizona in the continental United States, attended this year's Air Tattoo.

FROM ALPHA TO BRAVO

Written by Alan Firbank

Breath new life into your old Revell Bones with Barracuda's extensive range of resin upgrades

However you look at it, the Revell 1:48 Lancer is huge!

Here's the centre section of the fuselage laid alongside the Freedom Models F-20…

I expect we have all done it; returned home, proudly clutching the latest purchase, open the box only to find that the contents are not quite what was expected. In this case, it was a very large box containing a matching let-down. Revell's 1:48 B-1B is one of the largest injection-moulded aircraft kits ever made, creating a 'B-1B' that is almost a meter long. My copy of the kit was bought about fifteen years ago, but most of the parts go back even further to the mid-eigthies. I have kept the faith and carted this huge box with me in three house moves, vowing that one day it will be built. One day someone would come to my rescue and provide the parts to turn this turkey into something resembling a B-1B Lancer.

The problem is that the kit was originally a B-1A and despite the wording on the box, the contents did not change very much to comply with the kit's new title. It's interesting to see that after all this time Revell's instructions have not improved, whilst plastic parts and decals are of a good standard. Many military aircraft, the B-1B being a good example, have evolved, items being added (and removed) to cope with changing operational requirements. The B-1B Lancer has several changes to the airframe that are not present in the old kit and several of these, such as the jet pipes, are not easy to change without sourcing upgrade/detail sets.

The Kit

Making small allowances for its age, the kit parts are not bad at all. As supplied, the cockpit interior will build up into a decent replica of the real thing, especially considering much of it will become invisible. Though looking dated now, the B-1 cockpit

The undercarriage of the B-1B is a dominant and highly detailed part of the overall design. Barracuda's wheels and SAC's white-metal legs, will take care of these, nicely… (Alan Firbank)

B-1B Lancer from Dyess AFB, Texas basks in the summer sun at the International Air Tattoo, Fairford. (Alan Firbank)

Viewed in profile, the flowing lines of the Lancer are a sight to behold. (Alan Firbank)

parts were equal to any around at the time of initial release. The box shows a pair of upper cockpit hatches opened to view the rear cockpit interior. I've never seen these opened and I am guessing would only be opened to remove the seats for maintenance, or in an emergency.

Most of the kit's parts involve the cockpit interior, the contents of the weapons bays and the undercarriage. And then we move on to the huge airframe! The span of the tailplanes is about the same as the wingspan of a Phantom in the same scale, each wing being just under 400 mm long. The fuselage is split into three: the nose section (split vertically), the main fuselage (split horizontally) and the tail, also split vertically. The tailplanes and wings are provided as upper and lower halves. Test fitting the main wing halves shows a magnificent trench running the length of the wing parts on the lower half. The Lancer's wings feature huge flaps and leading edge slats that are not separated on the kit parts but luckily flaps and slats are all normally closed on parked Lancers. The tailplanes are normally set with the leading edge upwards. Test fitting of all of these large fuselage sections shows that the build will not be filler-free but overall, fit is quite acceptable. The transparent parts are tinted, but the tint is not appropriate to the landing lights, etc. It would have been easy to provide a tinted sprue and a clear one to cater for the two different requirements. Another feature of the kit that is not universally popular with modellers is the set of 'rubber' tyres.

Two decal options were provided in the kit I bought all those years ago: one with a pattern of grey and green and one in overall Gunship Gray as currently applied to all Lancers. There

Power and grace - our B-1B blasts off from Fairford's huge runway. (Alan Firbank)

are now two other schemes in the latest release, the choices being as follows, both being in overall Gunship Gray:

- Rockwell B-1B Lancer, 77 Weapons Squadron, USAF Weapons School, Dyess AFB, Texas, October 2012
- Rockwell B-1B Lancer, 116 Bomb Wing, Georgia Air National Guard, Robins AFB, Georgia, July 2000

Whatever your choice, you will need copious amounts of paint to cover this huge model. For the Gunship Grey option, tins of Tamiya's AS-27 spray paint will be ideal, but I estimate needing at least three cans. Revell's decal sheet is superb, providing markings for two aircraft and a good selection of

A very smart-looking B-1B from Ellsworth AFB shows off some its details including jet pipes, deflected tailplanes and wing seals. (Alan Firbank)

"The problem is that the kit was originally a B-1A and despite the wording on the box, the contents did not change very much to comply with the kit's new title"

ARMED, UNAFRAID AND UNMANNED

We tell the story of the development and first flights of the incredible X-47

By Model Airplane International

1: The unveiling of the X-47B UCAS at the Northrop Grumman facility on December 16, 2008 was a typical high-profile American event, there would be a lot riding on this program and those present knew it. All images Northrop Grumman via author

2: Hidden from public view for quite a few months, the prototype X-47B is pictured at Palmdale, California in 2010 for undisclosed test work. The 62ft (19m) wingspan is apparent.

Leaders within America's Pentagon often speak of the need for disruptive technologies within the US Navy (USN) Fleet, in order to fend off the ever-shrinking defence budgets that are slowly reducing America's technological superiority. The result of these cuts is slowly improving a potential adversary's capabilities. The idea of an unmanned air vehicle (UAV) that both the USN and USAF could use with little modification, under a program called Joint-Unmanned Combat Aircraft System (J-UCAS), and run by Department of Defense's team known as the Defense Advanced Research Project Agency (DARPA) seemed too good of an opportunity to miss. It would be cheaper than a manned fighter, and eliminate the risk of loosing aircrew.

While the fleet of the USN's super carriers remain untouched by budget cuts, what will be flying from them in the near future may send shockwaves through the 'old guard' of navy pilots.

The idea of operating drones from ships is not new; a small number of reconnaissance UAVs were launched by a rudimentary catapult from US battleships during the first Gulf War in 1991, but the goal of operating unmanned combat air vehicles (UCAVs) from the deck of a super carrier is only now becoming a reality. The delay was caused by a reluctance of senior USN Admirals to foresee where an 'armed' UAV could be used? Reducing a carrier's manned Air Wing, to make space was fiercely opposed. The technology of UAVs back in the 1990s meant they were incapable of 'catching the three-wire' on a carrier deck. But, by the early 2000s the

3: With its gear down for the duration, the X-47B (AV-1) took to the air for the first time on February 4, 2011 at Edwards Air Force Base, California. 4: Flight-testing continued at Edwards Air Force Base, throughout 2011. Pictured is AV-1 landing at the site after an avionics test flight. 5: Coming into land at Edwards the numerous high-lift devices and flaps on the trailing edges of the X-47B are evident. 6: The availability of two X-47Bs enabled the UCAS-D program to be conducted at a faster pace than previous UAV test programs. While one X-47B was in the air the other could be modified and prepared for its flight.

technology and expertise was available. The success of the USAF's Reaper and Predator programs demonstrated that the USN would now be playing catch-up if it wanted its own UAV that could seamlessly work within a carrier's Air Wing.

In mid-2000 the USN finally committed to the UAV programme, but was keen for the unmanned platform to have an offensive role from the beginning. A $2 million contract was awarded to both Boeing and Northrop Grumman with a stipulation that the concept-exploration stage had to be completed within 15 months.

For each company the UCAV that they were designing had to operate in a corrosive saltwater environment, survive the rigours of deck landings, catapult launches and be able to operate within a carrier's high-electromagnetic-interference environment. Belatedly added to the draft, was a reconnaissance role. Navy planners envisioned that UCAVs would penetrate protected airspace and identify targets for the following carrier's Air Wing.

Northrop Grumman's proof-of-concept UCAV was designated the X-47A Pegasus. The programme was initially funded purely by Northrop Grumman with some technical assistance by DARPA, whereas Boeing's X-45 sought funding from outside sources.

Suitably impressed the USN awarded Northrop Grumman the contract for a naval UCAV demonstrator, the X-47A. The proof-of-concept vehicle was built under contract by Burt Rutan's Scaled Composites at the Mojave Spaceport and powered by a single Pratt & Whitney Canada JT15D-5C high-bypass turbofan. With a 55-degree leading edge and a trailing edge of 35-degree the X-47A resembled an arrowhead.

The X-47A was publicly rolled out on July 30, 2001 and after a protracted ground-testing phase finally flew on February 23, 2003 at the US Naval Air Warfare Centre at China Lake, California. The testing phase did not involve any weapons drops even though two bays were built into the underside of the Pegasus, for 500 lb precision-guided bombs or missiles. Carrier landings and the associated technology were investigated, but the X-47A did not have an arrestor hook fitted. Other trials associated with carrier operations involved adding deck tie-downs without compromising the UAVs drone stealth characteristics, designing access panels that would not be blown out or damaged during deck operations.

Going It Alone

It was clear, based on DARPA's negative results and a Department of Defense Review, that the J-UCAS program should be terminated, which it was in February 2006. The USAF and USN would now develop their own specific UAV programs. The navy selected Northrop Grumman's X-47B as its next Unmanned Combat Air System Demonstrator (UCAS-D) program.

Northrop Grumman, aware of the significance of the project elected to build a demonstration vehicle to the same weight as the projected operational aircraft, with a full-sized weapons bay capable of carrying existing missile systems.

The first X-47B prototype rolled out of Air Force Plant 42 in Palmdale, California on December 16, 2008. Its first flight was initially planned for early November 2009, but was delayed by a series of technical problems which saw the project was fall behind schedule. On December 29, 2009, Northrop Grumman conducted a series of ground tests of the X-47B at the Palmdale facility - away from prying eyes. The aircraft taxied for the first time under its own power in January 2010.

Testing, Testing, Testing

It was more than one year later when the X-47B demonstrator, now designated Air Vehicle (AV-1) took to the air at Edwards Air Force Base, California in February 4, 2011. But these early test hops were merely handing flights to establish basic communication between the ground station and X-47B in order to pass on flight information. The UCAS's undercarriage remained extended and the weapons bays stayed closed.

A second X-47B demonstrator, designated AV-2 conducted its maiden flight at Edwards Air Force Base on November 22, 2011.

As a precaution, the two X-47B demonstrators were planned to conduct a three-year test program, with 50 flights scheduled from Edwards AFB and Naval Air Station (NAS) Patuxent River, Maryland, which were to culminate in sea trials in early 2013. This 36-month test period allowed for any technical issues that would present themselves

7

8

7: For its first flight out of Naval Air Station Patuxent River, Maryland in July 2012 the X-47B was accompanied by an F/A-18 Hornet. The exceptionally clean lines of the UCAS are clearly demonstrated.

8: On its way back to the 'Pax River', AV-1 is pictured in the spring of 2012 during its carrier suitability testing. Note the slightly displayed flaps on the port wing, in order to keep formation.

during early tests. However, the X-47s both performed perfectly without any major issues that, the preliminary flights were stopped after just 16 sorties.

Flush with success, Northrop Grumman program managers and USN decided to use the X-47B to demonstrate carrier launches and recoveries, as well as autonomous inflight refuelling with a probe and drogue. In late 2011, the navy announced that aerial refuelling equipment and the associated software would be added to just one of the Air Vehicles for testing in 2014.

At the time the USN publicly announced that neither X-47s would be armed. This was at a time when US drone operations overseas were receiving negative public opinion within the US press media; the USN was keen to keep the offensive role of its next generation drones free from public scrutiny.

In early 2012, Northrop Grumman tested a remote control system, designed to allow deck crew to steer the X-47B on a carrier deck, in all weathers. These tests took place at Edwards AFB with a simulated carrier deck painted onto the tarmac in a corner of the main ramp.

To The Boat And Beyond…

As the required tests related to the pending carrier operations were slowly 'ticked-off' Northrop Grumman's list, the USN now took the lead in the program. In May 2012, AV-1 began a series of tests developed to evaluate how the X-47B would operate in a high-intensity electromagnetic environment. Known as 'interference testing' the Patuxent River test team looked at the AV-1's ability to operate against planned electronic warfare systems, not only those of adversaries but what would be emitted from a carrier at sea.

One month later, AV-2 arrived at the NAS for its test period, which included arrested landings, and catapult launches; to validate the ability of the U-CAS to conduct precision approaches to an aircraft carrier's deck. Although these trials were all simulated at the test site, it's how the USN conducts testing any future carrier-based aircraft, UAV or helicopter. Any missed approaches during the carrier landing evaluation period, simply meant the operator can let the aircraft continue down the main runway without any risk or damage. The X-47B would simply not end up in the water! The drone's first land-based catapult launch was successfully conducted on November 29 of that year. But, eager to test the X-47B in a naval environment, trials has already begun aboard the USS Harry S. Truman on November 26, the embarkation of the drone was viewed as one of the first carrier-based evaluations for new procedures required when

"The idea of operating drones from ships is not new; a small number of reconnaissance UAVs were launched by a rudimentary catapult from US battleships during the first Gulf War in 1991"

9: Although only one night flight was conducted during the tests, Northrop Grumman intended for the follow-on UCLASS to be able to operate in all weathers, day-or-night.

9

operating a drone on a deck. By December 18, 2012 the X-47B had completed its first at-sea phase with an overall rating by senior US Navy officers of ‘outstanding’. The drone has proved itself to be flawlessly assimilated into the high workload of a carrier deck. Easy to move above and below deck, the X-47B proved to have ‘perfect’ communication with the carrier’s systems and on a number of occasions the test evaluation order was changed at short notice, which caused no problems to the drone’s on board software.

To The Boat…

Having completed its ‘carrier deck trials’ in port the X-47B returned to NAS Patuxent River for further tests, which culminated on May 4, 2013 with an arrested, landing on the simulated carrier deck at the naval air station. There was now little point in waiting, and the X-47B returned to a carrier, this time USS George H. W. Bush in the Atlantic Ocean. On the morning of May 14, 2013 the X-47B was catapulted off the front, in a landmark moment - the first time that an unmanned drone was ‘shot’ off a US carrier. Shortly after, on May 17, another milestone was passed with a series of touch-and-go landings and take-offs on the carrier at sea in the Atlantic Ocean.

On July 10, 2013, the X-47B took off from NAS Patuxent River and landed on the deck of USS George H. W. Bush, conducting the first ever arrested landing of a UAV on an aircraft carrier at sea. The drone later completed a second arrested landing on the carrier, but a third attempt failed due to a technical problem forcing the drone to divert to Wallops Flight Facility in Virginia. It was later identified that one of the X-47B’s three navigational sub-systems failed, which was identified by the other two sub-systems. The drone’s anomaly was indicated to the mission operator, who followed the test plan procedures to abort the landing. The USN later stated that the aircraft’s detection of a problem demonstrated its reliability and ability to operate autonomously.

There followed another high-profile problem a short time later when the second X-47B demonstrator, designated 501 aborted a planned landing on USS George H. W. Bush due to technical issues. Northrop Grumman officials were quick to point out that only one successful at-sea landing was required for the program, although testers were aiming for three, and only two out-of-four were achieved.

Regardless of these problems the US Navy continued to operate the X-47Bs throughout 2014. The service was intending to retire both drones, but faced a public backlash over their cost and short flight test phase. In an effort to divert criticism from the X-47B programme, the navy deployed the drones for three further carrier test phases between 2013 and 2015, with the intent to demonstrate that the X-47Bs could work within a 70-aircraft carrier Air Wing during routine operations.

Final Phases

On September 18, 2013 the X-47B conducted its 100th flight for the UCAS-D program – by July the following year the program objectives had been completed. These composed of 16 precision approaches to the carrier flight deck, including five tests of the X-47Bs wave-off functions, nine touch-an-go landings, two arrested landings and three catapult launches.

Sea trials aboard the USS Theodore Roosevelt in 2014 were the most dramatic, as the X-47B’s ability to swiftly take off; land, and hold in a pattern among manned aircraft without disruption to carrier operations were evaluated further. The drone also operated with a jet-blast deflector on deck for the first time, allowing it to conduct takes offs without disrupting operations taking place behind it. These trials culminated on April 10, when the X-47B completed its first night flight.

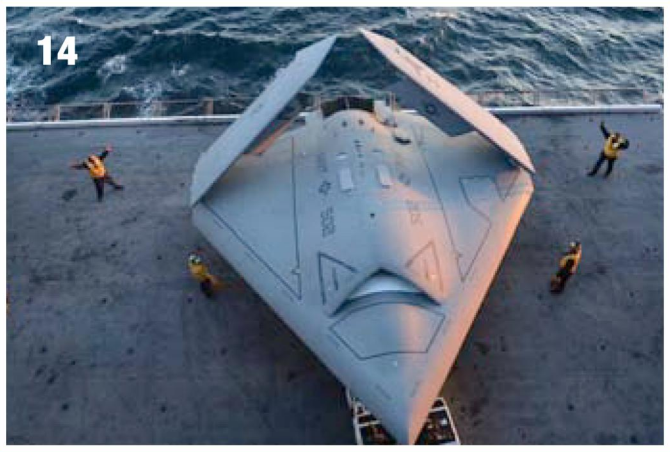
Landmarks continued to be made during 2014, as the US Navy sought to gain funding and interest in the idea of having

10: In landing configuration for the carrier, the UCAS is on final approach to Edwards Air Force Base, in this case during another test flight in November 2011. The beefy size of the carrier-style ‘shock absorbing’ undercarriage is clear.

11: The first shore-based catapult launch on November 29, 2012 at NAS Patuxent River. Testing at a land site was far less risky than conducting the early tests on a carrier out at sea.

12: The hand-held control test unit under evaluation by a US Navy crewman at ‘Pax River’ as he taxies the X-47B around the mock carrier deck at the naval air station.

13: One of the two X-47Bs is hoisted aboard the carrier USS Harry S. Truman on November 29, 2012 to begin a series of deck handling evaluations. The carrier remained in port the whole time and the deck was cleared of any of the carrier’s ‘regular aircraft’.



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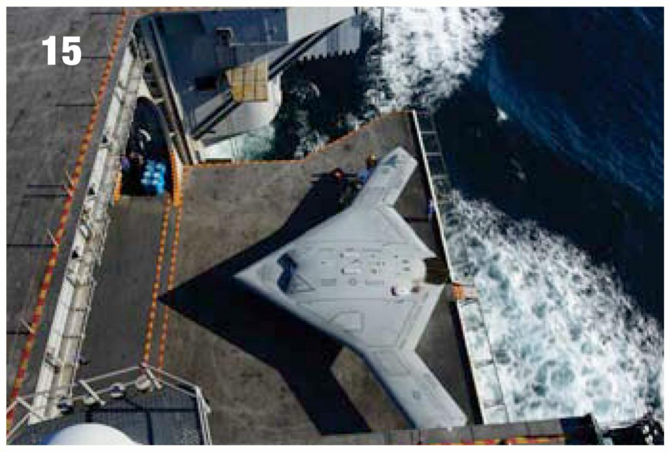

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a ‘operational’ drone based on experience gained with the X-47B. On August 17, the X-47B took off and landed on the USS Theodore Roosevelt alongside an F/A-18 Hornet, marking the first time an unmanned aircraft operated in conjunction with manned aircraft aboard an aircraft carrier. The Hornet was launched from the carrier, followed by the X-47B. Both flew around the ship eight times, and then the X-47B touched down and then took off again to verify that all systems were working correctly. After 24 minutes, the X-47B landed on the deck and was taxied away to give the Hornet room to land. All test objectives were met in the demonstration. These trials marked the fifth test period at sea, having completed eight catapult launches from a carrier, 30 touch-and-goes, and seven arrested landing aboard the USS George H. W. Bush and USS Theodore Roosevelt. The testing was successfully completed on August 24, 2014, with the X-47B completing five catapult launches, four arrestments and nine touch-an-go landings. Night taxi and deck-handling operations were also performed for the first time.

The X-47B met its objectives of performing launches and recoveries at 90-second intervals with manned Hornets. In April 2015, the X-47B successfully conducted the world’s first fully autonomous aerial refuelling, rendezvousing with an Omega Air KC-707 tanker over the coast of Maryland. This marked the effective completion of the X-47B’s development, as it had now completed all the primary demonstrations tasks required of it.

14: The Atlantic Ocean, May 14, 2013. Sailors move the X-47B onto the USS George H. W. Bush’s deck elevator in preparation for a series of carrier launches. With its wings folded, the UCAS uses little deck space: less then that of a Super Hornet. US Navy

15: A UCAS-D team move the X-47B from the hangar deck to the flight deck as part of the trials to demonstrate the drone’s compatibility with normal carrier operations.

16: In December 2012, the X-47B UCAS-D became the first unmanned system to taxi on the deck of the US Navy ship underway. The taxi occurred while the USS Harry S. Truman was under way off the coast of Virginia.

17: Once hoisted aboard the USS Harry S. Truman in November 2012, the UCAS demonstrated that it needed little specialist equipment when embarked within the ship.

“The X-47B already carries about 85% of the payload of the F-35 Joint Strike Fighter – and carries it three times further”

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18: Prior to landing aboard the USS George H. W. Bush the X-47B performed a number of approaches to test the UCAS's ability to 'power away' following a wave-off from the landing deck crew. US Navy

19: History in the marking – the X-47B lands on the deck of USS George H. W. Bush – catching the three wire! In the background is a C-2A Greyhound COD aircraft from Fleet Logistics Squadron 40 Det.2 (VRC-40) 'Rawhides' which was supporting the UCAS-D trials.

20: The shape of things to come for the US Navy? USS Harry S. Truman completed a series of deck trials with the X-47B testing all aspects of operating with unmanned aboard a carrier at sea.

21: A wealth of panels and sensors cover the upper surfaces of the X-47B. The exceptionally clean design and flush fitting panels ensure that 'stealth' still remains a factor in the design of future combat aircraft systems.

22: This underside view of the X-47B shows the location of the arrestor hook and three large blade aerials. During the trial Northrop Grumman engineers felt that panels to cover the tail hook were not needed, although any production UCAS-D would have them present in order to reduce and radar cross-section returns.

23: The landmark autonomous aerial refuelling of the X-47B from an Omega KC-707 tanker while over the US Navy's Atlantic Test Range on April 22, 2015.

But it had not been without cost. The project was initially funded under a US$635.8 million contract awarded by the USN in 2007. By January, the X-47B's total programme cost had grown to an estimated $813 million. Government funding for the X-47B UCAS-D programme was to run out at the end of September 2013, however in June 2014, the USN provided an additional $63 million for what they called 'post-demonstration' development of the X-47B.

In February 2015, the USN stated that the competition for private tenders for constructing the Unmanned Carrier-Launched Airborne Surveillance and Strike (UCLASS) fleet would begin in 2016, with an aircraft expected to enter service in early 2020s.

Although some way off, the plans are already being made within carrier Air Wings. The Secretary of the US Navy, Ray Mabus recently stated that: "The Lockheed Martin F-35C will certainly be the last manned strike fighter aircraft that the Department of the Navy will ever buy or fly." The X-47B already carries about 85% of the payload of the F-35 Joint Strike Fighter – and carries it three times further. The next few decades should witness some remarkable changes within USN carrier Air Wings. ●

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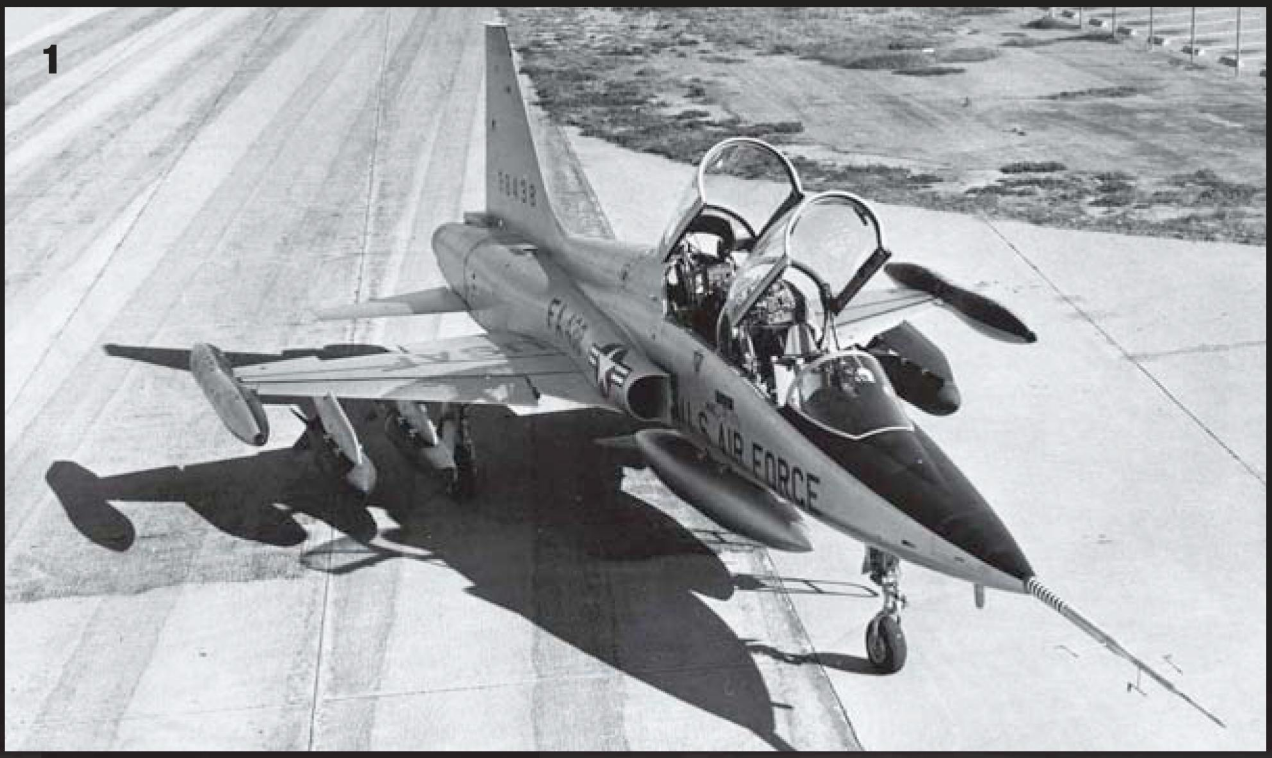
F-5B ...TRAINING THE FREE WORLD

Easy to maintain, cheap to purchase with docile handling for a fast jet of its time, the Northrop F-5B had all of these qualities in spades. It's why nearly 40 years after it took its first trainee fighter pilots aloft, a small number of nations around the world are still reaping the benefits of this remarkable sleek-looking jet trainer.



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In the early 1950s as the superpowers were busy equipping their air forces with the most sophisticated and expensive fighters available; a Northrop marketing team toured the smaller member countries of NATO and the South East Asia Treaty Organisation. From studying the resulting visit reports Northrop identified a clear need for a low-cost multi-role aircraft. This materialised as the NF-156F lightweight fighter. Chosen by the US Department of Defense as the aircraft to be supplied to allies and other favoured nations under the Military Assistance Program (MAP), the NF-156F was developed for production into the single-seat F-5A.

A two-seat variant designated the F-156T received USAF funding under a contract for a Lockheed T-33 trainer replacement and became operational, as the T-38 Talon, in March 1961. The Talon achieved many note-able distinctions including being the first

1: The first production F-5B, serial 63-8438, is pictured just after its rollout to the waiting aviation press. Even at this early stage Northrop was keen to 'push' the ground attack aspect of this trainer and subsequently loaded the aircraft with practice bombs under its wings for the occasion. USAF via author

2: A mixed formation of USAF operated F-5As and F-5Bs fly in formation shortly after entering operational service. USAF via author

2

3: Two newly delivered F-5Bs, 63-8441 and 63-8444 conduct a local familiarisation flight from their home base. It would be many years before the USAF examples adopted a camouflage scheme. USAF via author 4: (TWO SEPARATE REPORT STATE THIS AS AN F-5B/ANOTHER AS A T-38!) Near the end of their career with the USAF and in a reflection of combat operations then on-going in Vietnam, a small number of F-5Bs received the typical TAC camouflage of tan and two greens with light grey undersides. This F-5B was serving at Luke AFB, Arizona. USAF via author 5: Norwegian F-5s had provision for the attachment of JATO bottles, arrestor hooks and windscreen de-icing. Upon entering service the aircraft wore a silver lacquer finish with the minimum of squadron markings. Images all author's collection unless stated 6: Greece received its F-5s as part of a US-led re-equipment and modernisation attempt. Over the years the F-5 fleet wore many paint schemes, mainly as result of the aircraft being second-hand from other air forces, and a lack of money to repaint the airframes.

supersonic aircraft in US service to complete its test programme without a major accident and having the best accident record of any USAF supersonic aircraft.

Northrop saw further potential in their original design as a combat-capable two-seater for the overseas markets and air forces that were now signing up to order F-5As by the hundreds. Designated the F-5B, the new two-seater combined the tandem cockpit of the T-38 with the airframe of the F-5A, retaining the single-seater's under wing hard points, wing leading-edge extensions and flaps, and bigger engine intakes. Only two 20-mm cannon were missing. A separate windscreen would shield the backseater if the front canopy was lost or jettisoned. The F-5B prototype, serial number 63-8438, made its maiden flight on February 24, 1964, but the first was accepted by the USAF within a month and the type entered service on April 30, 1964, with Tactical Air Command's F-5 training programme with the 4441st Combat Crew Training Squadron (CCTS), which was equipped with seven single-seat F-5As and five two-seat F-5Bs.

Despite being a USAF unit, the role of the 4441st CCTS was to train pilots and ground crew from customer nations. The basic aim was to train six pilots, two maintenance officers and 50 enlisted men as instructors, for them to act as the nucleus on return to their own countries. The standard course lasted 45 days, and included 182 hours of ground school, including 115 hours of classroom instructions and 50 hours of one-to-one briefing and critique. To this was added 40 flying hours in 30 sorties, including 25 hours in the single-seat F-5A. The common core language used was English, and a 15-week language indoctrination course was offered to students not sufficiently fluent to commence training. The first class assembled in September 1964 and consisted of six Iranians, four Koreans and two American Military Assistance Advisory Group (MAAG) pilots. The MAAG pilots would be responsible for helping MAP customers integrate their new F-5s, and would assist in setting up their own training programmes. The first students completed training in March 1965. The aircraft flown by the 4441st wore USAF insignia and serials, but were actually MAP aircraft owned by the nations whose pilots were undergoing training. Despite their newness, the 4441st CCTS F-5s proved reliable. Availability averaged 80%, and maintenance man-hours per flying hour averaged 23 hours initially and were later reduced to 21.

Confirmation that further countries had selected the F-5 followed rapidly. In February Norway having made some adjustments to its defence budget, announced that it would meet just over a third of the total cost of 68 aircraft for delivery in 1966-67.

Northrop completed another five F-5Bs, 63-8440 to 63-8444 before selecting the eighth example 63-8445 as a company demonstrator. This aircraft undertook its first sales tour in 1964, visiting 12 European and Middle East countries between June 15 and September 15.

I'll Take One of Each!

It now became common for an air force, which was ordering the F-5A as its primary attack aircraft to order a smaller number of the two-seat trainer variants at the same time. First to do so were the Imperial Iranian Air Force with an order for two F-5Bs on February 1, 1965. South Korea received five F-5Bs in April 1965, which were operated by the 105th Fighter Squadron of the 10th Fighter Wing at Suwon. A further 31 F-5Bs were ordered later by the Republic of Korea Air Force, which made it one of the largest operators of F-5s in the world at the time. Early model F-5s, such as the two-seat B variant remained in service until mid-2005.

Greece was quick to see the potential of the F-5 and initially received its first examples in the same month as Norway, June 1965. At that time Greece was a full member of NATO with its air force forming part of the 6th Allied Tactical Air Force. It ordered 80 F-5s split across three variants, nine of which were F-5Bs. An additional order in late 1968 saw a further 20 two-seat trainers delivered. The aircraft were distributed between three Mirai (Squadrons): 341 Mira (Squadron) at Nea Ankhialos in 111 Wing, 343 Mira that was part of 113 Wing and 349 Mira. Deliveries were suspended for a short time following a diplomatic row, which was only resolved in 1968, so allowing the ordered to be completed.

To counter-balance the Greek delivery a similar number of F-5 were supplied to Turkey, later ten Canadair NF-5B were delivered by the Netherlands in 1991. These planes' service life was rather short in Greece as there was no standardisation with other F-5s then in service

7: The Turkish Air Force received its first 13 F-5Bs in 1965 and they remained in service through to early 2000. Note the subtle camouflage differences between 5-033 and 3-449. A large orange baggage pod is mounted on the centreline. 8: Showing the final configuration of Royal Norwegian Air Force F-5Bs is 243 as it taxies towards the main runway at RAF Fairford after the Air Tattoo in 1996. Note the 'borrowed' green camouflaged fuel tanks and the lack of any squadron insignia. 9: A Royal Netherlands Air Force NF-5B, K-4019 from 314 Squadron takes off from Eindhoven during a NATO air exercise in June 1977. This was the standard camouflage for the NF-5 fleet for many years. In the rear cockpit is a blue hood used to train students for instrument flying. 10: With the back-seater taking a picture of the photographer seconds before take off, F-5B, 907 clearly shows the upgrades made to the Royal Norwegian Air Force fleet. Chaff dispensers on the rear fuselage and RWRs mounted in the nose. Norwegian F-5s were always kept extremely clean in their final years of service. 11: Spanish F-5Bs retained their silver lacquer finish for a number of years, AE9-015, from Escuadron 732 of Ala 73 prepares to taxi out during a squadron exchange in the United Kingdom. 12: The introduction of camouflage to the Spanish F-5B fleet in the 1980s is typified in this view of AE9-018/21-73 of Escuadron 212 of Ala 21. The sand, brown and green highlighted the 'sports car looks' of the F-5B. 13: Dutch NF-5s used a multitude of grey camouflage schemes in the last decade of their service. This NF-5B, K-4028 tries hard to look like an F-16! At the time this NF-5B was serving with 316 Squadron at Eindhoven in 1987. 14: Perhaps the most public role of the F-5B is as the mount of 134 Filo 'Turk Tildizlari' (The Turkish Stars) display team. 15: A small number of F-5Bs saw combat in Vietnam supporting the USAF's Skoshi Tiger deployment of F-5As to the region. USAF 16: A South Vietnamese Air Force F-5B 13074 from the 522nd Fighter Squadron at Bien Hoa Air Base rests in a hangar in early 1970 prior to conducting another strike mission against the advancing North Vietnamese. USAF via author 17: Wearing the red 'X' of the Aerospace Engineering Test Establishment (AETE) on its rudder, this Royal Canadian Air Force CF-116D, 116801, has bright orange test equipment installed in its rear cockpit. 18: With drop tanks borrowed from a number of differently camouflaged CF-116s, CF-116D, 116825 from 419 'Moose' Squadron heads back to its home base at Cold Lake in June 1992. An instrument flying hood is mounted on the inside of the rear canopy.

and the NF-5Bs were retired in 1997.

Those F-5Bs and NF-5Bs that remained in service into the late 1990s were passed between squadrons as they slowly re-equipped with F-16s. By March 2000, 343 Mira was the final home for a mixed fleet of F-5s until their retirement in 2001 after 36 years of operational service.

As related earlier, Norway was able to part-finance supplies of F-5s under MAP by reducing the number of F-104 Starfighter squadrons in service from two to one. The first aircraft for the Royal Norwegian Air Force (RNorAF) was delivered to 336 Squadron at Rygge Air Base after a 6,200-mile transit flight from Edwards AFB, California. Norwegian aircraft had provision for jet assisted take-off, windscreen de-icing and arrestor hooks all of which increased the operational efficiency if the F-5 were required to operate from less than hospitable airfields. Between 1966 and 1968, 24 F-5Bs, were distributed amongst squadrons at 336 (Rygge Air Base), 338 (Orland Air Base), 332 (Rygge Air Base) and 334 (Bodo Air Base). Each squadron had a statutory strength of 20 aircraft F-5As, assigned to Allied Forces Northern Europe.

The RNorAF suffered a large number of losses with their F-5s losing 16 aircraft causing the number of squadrons to be reduced in 1973 from four to three. Later modifications made the Norwegian examples the best-equipped aircraft of this type in the world for a long time. Further modifications, in order to prolong the life of the aircraft started in 1984 at Fokker's in Holland. Improvements to the avionics and anti-corrosion protection were performed. In February 1991, a substantial programme to upgrade the weapons and navigation systems on eight F-5Bs commenced and was completed in 1994. All the remaining F-5s, both single-seat and two-seaters were delivered to 338 Squadron. A number of structural improvements were performed between 1993-94 on the tails and wing spars by Bristol Aerospace in Canada.

The eight modernised F-5Bs remained in service with 336 Squadron at Rygge where they served as chase-aircraft in the testing of the Norwegian Penguin anti-ship missile in 2000. Once the development of the missile was completed in December 2007, the F-5Bs were put up for sale.

Licence Production Overseas

Northrop's part stake in the Spanish aerospace concern Contucciones Aeronauticas S.A. (CASA) led to an agreement on licence assembly when the Spanish Air Force decided to modernise its fighter attack element with the F-5 in 1966. A total of 70 machines were covered by the order: 19 F-5As, 34 F-5Bs and 17 reconnaissance RF-5As. These took the dual designations SF-5A, SF-5B and SRF-5A

to distinguish them from US-built examples. However, in common with other aircraft in their inventory, the Spanish designation; C.9, CE.9 and CR.9, the F-5 being the ninth fighter type operated since the Ejercito del Aire (Spanish Air Force) became an independent service in July 1939, was adopted.

The first eight aircraft were supplied directly from Northrop as knockdown kits for assembly and thereafter CASA's plants at Seville and Madrid-Getafe assembled the balance of 62 from components shipped from the US, the first example being rolled out in June 1968 at Madrid. The construction programme lasted until 1971. The two-seaters were shared amongst Escuadrones - Esc (Squadrons) 202, 204, 211 and 212. The aircraft were later re-designated A.9 (F-5A), AE.9 (F-5B) and AR.9 (RF-5A). By the early 1980s four AE.9s had been lost, leaving just 30 trainers in service among the squadrons.

The A.9 fleet underwent a number of upgrades during their service the most significant taking place in 1988 begun by CASA and later taken over by British Aerospace of Canada, involving 22 aircraft. This was followed by a further upgrade by Israel Aircraft Industries, which was intended to extend the service life of the AE.9s and make the training of future F/A-18 Hornet pilots easier. New on-board computers, multifunction displays and a new navigation suite were installed and the aircraft were re-designated F-5Ms. As the Spanish Air Force gradually re-equipped with Hornets and Eurofighter Typhoons, the single-seat F-5s were slowly scrapped or a small number passed to other squadrons before they too were withdrawn from wide scale service. The two-seaters remained in service as advance fighter pilot trainers and squadron 'hack' aircraft.

Double Dutch

The Koninklijke Luchtmacht (KLu – Royal Dutch Air Force) selected Canadair built F-5 in October 1966. The two-seaters were designated NF-5Bs. Basically the same as the Royal Canadian Air Force CF-5s, the Dutch jets were fitted with more powerful Orenda J-85CAN-15 engines, an arrestor hook and a reinforced windscreen. Thirty NF-5Bs were distributed between three operational squadrons and one operational conversion unit, the first NF-5B (K-4001) flew on July 7, 1969. The first examples arrived in the Netherlands in October 1969 having flown from Canada via, Greenland, Iceland, Great Britain before arriving at the Dutch air base Twenthe.

During their career, the Dutch NF-5s had their avionics and weapons systems modernised and at the end of the 1980s, the wings and the horizontal tail surfaces and were reinforced in order to enable the jets to carry on flying until they were retired, RWR and ALE-40 chaff and flare dispensers were mounted to the rear fuselage. Four squadrons were equipped with NF-5s, with 313 Squadron at Twenthe Air Base operating the majority of the NF-5Bs as the Transition and Operation Conversion Course (TOCC) or operational conversion unit.

With the arrival of the F-16 Fighting Falcon in 1979, the phase out of the NF-5s began in 1985 and lasted until 1992. Those that remained serviceable went into storage and were eventually sold to Greece, Turkey and Venezuela.

Desert Duels

A host of Middle East and African nations operated limited number of F-5Bs on training and limited attack roles. Many of these aircraft were purchased second-hand from European air forces along with a small number bought directly from Northrop and Canadair.

The Royal Air Force of Morocco acquired four F-5Bs in 1966 as conversion trainers to support their F-5As. Ultimately the aircraft were eventually replaced by F-5Fs in 1980.

In 1971, the Royal Saudi Air Force received 20 F-5Bs, which were split between four squadrons. The aircraft were more sophisticated than most and came equipped with ALQ-101 ECM pods and ALR-46 RWRs.

Libya placed an order for 18 F-5As and F-5Bs in 1968. Only two single-seaters arrived prior to the military coup, which saw the Revolutionary Command Council take charge in September 1969. It's believed that the two trainers were eventually shipped to Pakistan or Turkey due to a lack of spares in the country.

Back in the 1960s Iran was a staunch supporter of US policy in the Middle East and as a result was an obvious client for the F-5 for its Imperial Iranian Air Force (later, Islamic Republic of Iran Air Force). Two F-5Bs arrived in country early in January 1965. A further 23 F-5Bs arrived in June the same year, although Iran later sold all its F-5As to Ethiopia, Greece, Turkey and South Vietnam. The trainers were retained and a small number remain in operational service serving in numerous support roles.

Under the moderate leadership of King Hussein, the Royal Jordanian Air Force was ironically refused deliveries of sophisticated fighters from the United States; instead they had to approach Iran in order to acquire 20 F-5As and two F-5Bs in 1974. A further two F-5Bs were supplied in later the same year allowing the formation of 2 Squadron as an advanced training unit. With a thawing in tensions between the US and Jordan the more capableF-5E/Fs soon began to arrive in 1975, which allowed the elderly F-5Bs to be sold to Greece.

With US approval Saudi Arabia transferred four F-5Bs to North Yemen in 1979. It is believed that the F-5s are now largely unserviceable although in 1994/5 the US government began covertly supplying spares for the F-5A/Bs in the country but there has been no confirmation on this from official sources.

Definitely A Turkey

As a member of NATO, Turkey began receiving F-5s as part of America's MAP in 1965. Thirteen F-5Bs arrived in country and this number was later increased with second-hand examples from Holland, Norway, Taiwan and the United States. By 1979 nine Filo (squadrons) of the Turkish Air Force were equipped with variants of the F-5. The United States continued to deliver F-5s to Turkey until 1991. Late in their service Turkey undertook an upgrade programme called F-5/2000, which involved

19: Forming up on his wingman this Spanish Air Force SF-5B was a licence-built example by CASA. Mounted on the wingtips of AE9-014 are a pair of early model AIM-9 Sidewinders.

20: The Canadian 'bad guys' flew CF-116Ds in a similar way to what their USAF counterparts had been doing at Red Flag years earlier. Serving with 419 'Moose' Squadron, 116805 wore a desert style camouflage during the sorties it flew in as part of Exercise Maple Flag. 21: A rare image of an Imperial Iranian Air Force F-5B, 10587 at Tehran International Airport in March 1967. Two squadrons were based at the airport until November 1979. 22: Though never serving in great number, the F-5Bs of the Philippine Air Force were maintained in excellent condition. Pictured at Clarke AFB, is 40780 on a weekend squadron exchange.

20 F-5Bs and six NF-5Bs. Consisting of a consortium of Israeli IAI/Elbit and Singapore Aerospace Technologies the update focussed on the aircraft's structure and avionics to improve the navigation suite. The first upgrade aircraft re-entered service in April 2001, all were to serve with 133 Filo.

Other operators of the F-5 included the Philippines, which at one time had three F-5Bs in service, although this was increased with a purchase from Taiwan of one additional example. Fatigue and a lack of spares quickly brought the aircraft's operational career to an end.

Under the Peace Amazon Programme, Brazil acquired six F-5Bs in 1975, which it split between its two operational squadrons. In 1974, it was intended to purchase additional F-5B trainers, but the order was changed to the newer Northrop F-5F. The earlier trainers remained in service until July 1985, with only two examples remaining operational. In March 1996, these two aircraft were offered for sale and placed in storage.

'Real World' Combat

The Vietnamese Air Force requested a jet-powered attack aircraft in 1966 from the United States. With the war in Vietnam growing, and following the Skoshi Tiger evaluation by the USAF a number of F-5s were supplied to the Vietnamese Air Force (VNAF), which included two F-5Bs, to the 522nd Fighter Squadron of the VNAF's 23rd Tactical Wing. It is believed that the F-5Bs conducted a number of strikes themselves along with F-5As, (designated F-5C in the United States). Following the ending of the war a small number of F-5Bs entered service with the North's Vietnamese Popular Air Force and a small number of these aircraft were later passed to the Warsaw Pact for evaluation.

Bordering Vietnam, is was inevitable the Thailand would also seek the latest US jet fighters to defend its air space during the Vietnam War. Along with single seat examples, the Royal Thai Air Force received three F-5Bs, which were joined by an additional two, purchased from Malaysian stocks. Serving with 701 Squadron until 1998, the trainers supported the later F-5E introduction into service and a small number remained operational in 2012 on various support duties.

Maple Leaf F-5s

In July 1965, the Canadian Government announced that it had chosen the Northrop F-5 as its new light attack aircraft. Canadair, based near Montreal obtained a licence to build F-5s from Northrop, with some minor changes to the original model. A more powerful engine, the Orenda was installed; an inflight refuelling probe and longer landing gear struts in order to give a shorter landing run. The Canadian practice of giving aircraft specific designations continued: CF-5A for the single-seat version, the CF-5D for the two-seat version and the CF-5A for the reconnaissance version, this did not last however, as when all three armed services merged in February 1968 and the CF-5 designation was changed to CF-116.

Twenty-six CF-116Ds were ordered; the first example No 116801 flew in August 1968 entering service the following year. Three air force squadrons were each allocated seven CF-116Ds each. Budget restrictions in the 1970s forced the reduction in the number of available CF-116s needed. The surplus jets were later sold to Venezuela, which picked up four CF-116Ds. Two further CF-116Ds followed in 1974. Ironically, a short time later the Canadian Air Command ordered 18 new CF-116Ds from Canadair to be based at Cold Lake Air Force Base to fulfil the 'adversary' role with 419 'Moose' Squadron during the annual large-scale air exercise Maple Flag.

Originally the CF-116s were expected to remain in service until late 2000, but cracks in the wings reduced the fleet of aircraft available and their withdrawal was announced in 1994. In June 1996 Botswana bought a number of the surplus CF-116s, which included two CF-116Ds.

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23: The first CF-116D, 116801 with its bare metal fuselage and high-visibility markings. Wing tips and horizontal tail planes are red as are the outer surfaces of the tip- tanks; their inner faces are matt black. The rear cockpit is full of test equipment. RCAF via author

REFERENCE FEATURE

IN DETAIL

Written and photographed by Spencer Pollard

We take a close look at the F-5B as flown by the Spanish Air Force in its SF-5M guise, providing plenty of detail for builders of this gorgeous aircraft in miniature.

1: Resplendent in its overall grey plumage, this Spanish Air Force Northrop SF-5M '23-16', basks in the Fairford sun.
2: The Spanish Air Force sent over two aircraft to Fairford - here's the second of the pair.
3: The nose of the F-5B is a very subtle shape, as can be seen here. Note the rippling around the nose panels and the slight blue tint in the windscreen glazing.
4: The nose cone is a blunt shape, the pitot tube blending in perfectly with the surrounding panel. Note the small intake on the side of the nose.

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5: The arched wheel mount is a delicate, open structure on the F-5. Compare this with the rather heavily moulded kit part… 6: Though simplified in the kit, the nose gear is a mass of detail. The aerial and rivet detail are noteworthy in this shot. 7: The panelling on the F-5 is anything but neat! Note the rippled finish and the obvious overlaps seen in this shot. The nose gear door is extremely thin and as can be seen here, hangs just off the vertical. 8: The interior face of the nose gear door. Note the hinges and the actuator, the latter secured with a locking pin. 9: On the ground the ventral air brakes hang down, the starboard brake being seen here. 10: The F-5 family is not particularly long-legged, so the use of drop-tanks is virtually mandatory. Note the gap between the upper edge of the tank and the lower edge of the pylon. 11: As FOD is an ever-present danger for modern aircraft, the use of FOD guards in the intakes of jet aircraft, is a regular occurrence. 12: From this angle, the flowing lines of the F-5 are shown off to advantage. Once again, note the raised paneling. 13: Nose detail. Here we can see the blown shape of the canopy and how the interior's Neutral Grey finish contrasts with the external Ghost Grey finish. 14: Careful study of this otherwise immaculate aircraft reveals some very subtle weathering.

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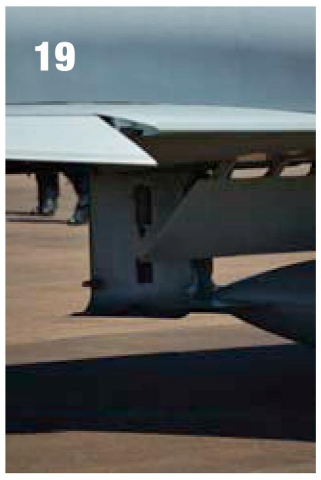
15: Tail feathers. Once again note the rippling around the rear of the aircraft and the open ram-air intake seen at the base of the tail fin. 16: One of the recognition features of the F-5B over the T-38 is the use of tip tanks, the flowing lines of the starboard tank being seen here. 17: Each tip tank is fitted with a light, blue on the starboard tank, red on the port. This would be an easy to add improvement to the Kinetic kit, the lamps being moulded solid on the kit parts. 18: Close up of the intake found at the base of the fin. This is moulded solid in the kit, some careful work with drills, files and a sharp scalpel blade being needed to open it up. 19: The underside of the F-5 is a mass of airbrakes, undercarriage doors and pylons. Note the drooped slat. 20: Close up of the under fuselage pylon. Note the panel detail, stencilling and different shades of grey on this important structure. The RBF tags would be a need addition to your model. 21: Another look at the nose gear. Once again, an RBF tag flies from this part of the aircraft. The wheel hub's silver paintwork contrasts against the white of the leg. 22: Kinetic's kit includes crew access ladders, their yellow paintwork adding a splash of colour against the surrounding camouflage. 23: A final view of our SF-5M. What a beautiful aircraft!



FINAL THOUGHTS

B-1B LANCER: TIME TO BUILD THE BIG ONE..?

Every so often a kit arrives that makes us a little more excited than I would normally be. This month that kit was Revell's reissue of their enormous 1:48 B-1B Lancer.

Ever since this kit was first released during the early 80s we've wanted to build it, but the sheer size of the project and the worry about housing it once it was complete (did I mention that it was enormous?!) has always put us off. Recently though, that desire has been rekindled by not only the kit being issued once more by Revell, but by Barracuda's creation of a whole raft of upgrades for it. Add to that the imminent release of a set of masks and etched brass details from Eduard, the ready availability of undercarriage parts from Scale Aircraft Conversions and the excuses for NOT building this incredible kit, are lessening by the minute!

But of course it's not the sort of model that you can just jump into headlong and hope to be able to work on to the exclusion of all others. The day job will not allow it for starters, but it's more the volume of work that would be needed to complete the project that's really the issue - it is not a weekend project that's for sure! - and so some careful thought may be needed, both in terms of planning and time management.

So MAI decided that the best way to do this would be to break it down into blocks that I can manage to complete around other, more pressing projects, starting off with the engines. These will need a major overhaul and thanks to the new intakes and jet pipes that Roy Sutherland has added to his Barracuda range, this should be a fun 'model within a model' that will get the ball rolling without too much trouble. The cockpit will be next and then the bomb bay and airframe changes. It is planned to paint and weather these parts as we go along, maybe working into the build a way of removing the wings for transportation and storage once the model is complete.

Having wanted to build this beautiful aircraft for the best part of thirty years, it seems that the time is right to get cracking. We'll be running the results of this lengthy project within the pages of this magazine, creating a series of articles that will explain in detail how the model is being built and subsequently painted. When this will begin is open to debate at the moment, but certainly hope that it will be within the next few months.

So, we're finally going to build Revell's 1:48 B-1B Lancer - wish us luck!

"Having wanted to build this beautiful aircraft for the best part of thirty years, it seems that the time is right to get cracking"

Written by Marcus Jellyman

THE ILYUSHIN IL-62

During the advent of the jet age, the West had developed aircraft such as the De Havilland Comet, Boeing B707, Douglas DC-8 and the Vickers VC-10. At the same time the Soviet Union were still using Tupolev TU-114 long range turboprop aircraft derived from the Tupolev Tu-95 Bear strategic bomber. In 1958 a contract was formally signed with the design bureau of Sergey Vladimirovich Ilyushin for a long range jet aircraft that could carry 150 people and their baggage at 550mph over a range of 5000 miles.

2: UK-86577 IL-62M Uzbekistan Airways
UK-86577 Ilyushin IL-62M c/n 2748552 in the beautiful colours of Uzbekistan Airways is seen arriving from Tashkent with a service to London Heathrow in the early 1990's. She was delivered to East German airline Interflug in 1987. Currently stored at Moscow Domodedovo with Interavia Airlines.

During the advent of the jet age, the West had developed aircraft such as the De Havilland Comet, Boeing B707, Douglas DC-8 and the Vickers VC-10. At the same time the Soviet Union were still using Tupolev TU-114 long range turboprop aircraft derived from the Tupolev Tu-95 Bear strategic bomber. In 1958 a contract was formally signed with the design bureau of Sergey Vladimirovich Ilyushin for a long range jet aircraft that could carry 150 people and their baggage at 550mph over a range of 5000 miles.

The Ilyushin bureau already had some experience with designing airliners with the IL-14 and IL-18 aircraft, but this was virgin territory and a totally different design to these early aircraft. At least six configurations were considered before a decision

1: CU-T1209 IL-62M Cubana
CU-T1209 Ilyushin IL-62M c/n 1328132 of Cubana de Aviacion was delivered new in 1978 and served with the airline operating to European capitals including, Madrid, Paris, Prague, Frankfurt and East Berlin. Cubana operated 28 IL-62's from the late 1970's until 2011. Many were leased with Cubana owning 19 of their own outright. CU-T1209 is seen here taxying after arrival at Paris' Orly airport after another service from Havana.

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3: RA-86466 IL-62MK Rossiya Airlines: RA-86466 Ilyushin IL-62MK c/n 2749316 of Rossiya Airlines who are wholly owned and operated by the Russian Government was delivered to them in 1987. One of a number of IL-62MK's operated by the Government she soldiered on until 2013 before being scrapped and replaced by an Ilyushin IL-96 aircraft. Here she is seen about to touch down, bringing dignitaries to the London 2012 Olympic. 4: RA-86561 IL-62MK Rossiya Airlines: RA-86561 Ilyushin IL-62MK c/n 4154842 of Rossiya Airlines was another Government operated aircraft from 1993 until 2014. This aircraft differs from others with its extended dorsal spine that extends half way down the fuselage. She is currently withdrawn from use at Moscow's Vnukovo airport. It is seen here bringing Government officials to the 2012 London Olympics. 5: RA-86570 IL-62M MChS Rossii – Russia Ministry for Emergency Situations: RA-86570 Ilyushin IL-62M c/n 1356344 named 'Mikhail Gromov' of MChS Rossii was one of the last IL-62's to be built and was delivered to Orient Avia as a VIP aircraft in 1995. It is seen here on a visit to London in September 2008. 6: SU-ZDA IL-62M ALIM Airlines: SU-ZDA Ilyushin IL-62M c/n 4445827 named 'Mrs.Laila' of ALIM Airlines of Egypt was first delivered to the East German Air Force in 1984 before being sold to Uzbekistan Airways in 1993. After only a short time with the airline it was sold to ALIM Airlines. She is photographed at Kiev Borispol on a bright but very cold morning in March 2007. Sadly now rotting away stored at Cairo Airport, Egypt. 7: UR-86582 IL-62M Air Ukraine: UR-86582 Ilyushin IL-62M c/n 3036253 of Air Ukraine still in basic LOT Polish Airlines colours was delivered new to LOT in 1980 and sold to Air Ukraine in 1992. The aircraftt had a short career with the airline and is seen here with her sister ships withdrawn from use at Kiev Borispol in March 1997. 8: SP-LBF IL-62M LOT Polish Airlines: SP-LBF Ilyushin IL-62M c/n 2343554 named 'Fryderyk Chopin' was delivered to LOT in July 1983 and was sold to Air Ukraine in 1992. LBF is seen here after pushback with a return service to Warsaw from London's Heathrow Airport in the late 1980's. Currently stored withdrawn from use at Kiev Borispol.

was made to have four engines in pair across the rear of the fuselage. With its resemblance to the Vickers VC-10, many observers considered it to be a copy of the British Aircraft, but the similarities were only in the exterior look of the aircraft.

Prototype (CCCP-06156) was rolled out of the Kazan (now Khazakstan) factory and show to the public and the then prime minister Krustchov for the first time on the 24th September 1962, and the first flight for the aircraft was in January 1963 flown by test pilot W.K.Kokkinaki. Development of the engines was tasked to the bureau of N.D Kuznetov. However, delays in the development meant these would not be ready for the maiden flight, so Lyulka AL-7 turbojets were fitted to (06156) and a few subsequent test airframes to begin the test phase. These engines were massively under powered and fuel thirsty compared to the Kuznetov NK-8 in development for the IL-62, meaning no aircraft could fly at maximum take-off weight and fuel use prediction figures were worthless. It wasn't until 1964 that further test aircraft were fitted with the new Kuznetov NK-8-3 engine, and from 1965 production aircraft were fitted with the NK-8-4 engine.

The Kuznetov NK-8 engine had performed well during the test flights, however newer technologies had been developed, and a new engine; the Soloviev D-30KU was chosen to be fitted to all subsequent production aircraft. These aircraft were designated the IL-62M. Delivery to the Aeroflot (the national airline of the Soviet Union) was in October 1966, and like most airliners developed in the country were first tested on internal cargo flights between Moscow and Almaty (the capital of Kazakstan). Regular passenger services finally began in the 10th March 1967 between Moscow and Khabarovsk in the far east of the country close to the Chinese border, and by the end of the year the IL-62 had taken over all international routes from the Tu-114, including Montreal, New York and Tokyo.

Export sales were pretty much limited to Eastern Bloc countries that had no choice but to order the IL-62 for their long range airliner requirements. CSA Czech Airlines were the first country outside the Soviet Union to operate the aircraft, with other operators such as, TAROM of Bulgaria, LOT of Poland, Interflug of East Germany, CAAC of China and Cubana of Cuba following on shortly after.

With Western aircraft design moving forward, the aircraft was given numerous upgrades to increase passenger seating and cargo capacity. In 1978 the IL-62MK was the largest of these upgrades, that while not externally that different, internally many re-designed areas of the structure were 'beefed up' to cope with the increased maximum take-off weight. Stronger landing gear that gave a greater footprint was also fitted to cope with the new weight.

Production of the IL-62 continued in Kazan up until 1995 with the last aircraft being delivered to the Sudanese Government. Over 290 aircraft were produced with over 30 countries operating the aircraft. Sadly only a handful of airframes are still operated either as passenger or government aircraft. The IL-62 certainly deserves its place in history, earning Ilyushin manufacturing plant the Lenin Prize. ●

Poles apart in terms of design but both are worthy opponents in the air-to-air arena. The Sea Harriers of the Royal Navy and the French Air Force Mirage 2000s operated together for years. The constant ACM exercises proved their worth during operations over Bosnia, with both types operating in partnership to ensure no NATO strike aircraft were attacked. FAA via author

BAE SYSTEMS SEA HARRIER FA.MK 2

Written by Model Airplane International

After the Falklands War, the Royal Navy's Sea Harrier pilots had proved themselves highly skilled and superbly trained: nonetheless, experts acknowledged that the Royal Navy had been lucky to meet an enemy who could not expose the Sea Harrier's fundamental weakness – it was a subsonic, unsophisticated fighter that had managed to blast Argentina's Mirages, Daggers and Skyhawks from the sky. In response the development of an ambitious Sea Harrier upgrade was accorded the highest priority and urgency. The result of the programme was the Sea Harrier FRS.Mk 2, an extremely advanced derivative of the original Sea Harrier with all-new capabilities, and was an aircraft viewed by many at the time as the best ship borne fighter in the West.

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1. ZA195 was the first of two FRS.Mk 2 development aircraft, making its first flight on September 19, 1983. This aircraft did not have radar, and carried a probe on the radome. Neither of the development aircraft had the dynamic pressure probe for the flight control system installed in the fin leading edge. RN via author. 2. Early FRS.Mk 2 deliveries were made in the original extra dark sea grey scheme with toned down national insignia. ZA195 carries black/white calibration squares on the nose and tail. The aircraft was heavily involved in missile development trials for the FRS.Mk 2. Author's collection

A number of minor upgrades had and were being performed on the FRS.Mk 1s then in operational service with the Fleet Air Arm (FAA) which were designated as the Phase I Updates however, by 1985 BAe and Marconi received a contract for the upgrading of 30 FRS.Mk 1s in what was designated the Sea Harrier Improvement Programme (SHIP), the Mid-Life Update (MLU) and finally as the Phase II Update. The heart of this upgrade was going to be the provision of a new radar and a long-range air-to-air missile, it was soon clear that these would be, respectively, Ferranti's ARI.50019 Blue Vixen and the Raytheon AIM-120 AMRAAM. The capabilities of the Blue Vixen radar were without dispute and early tests proved that it was as the most advanced lightweight high-performance radar then under development in Europe or the US.

Subsequently BAe in December 1988, was given a £170 million contract to upgrade 29 of the surviving Sea Harriers to FRS.Mk 2 standards (the total of surviving aircraft was then 35 aircraft, but this was reduced to 33 by continuing attrition). Four more conversions were funded in 1994 together with 18 new-build FRS.Mk 2s. An A-Model (Development) Blue Vixen was flight-tested over 121 sorties (114 hours) in a RAE BAC One-Eleven ZF433, and later in a pair of BAe 125s. The broadly representative A-Model radar was first flown in XW930 on August 26, 1988, while in September 1989 another BAe 125 ZF130 flew a B-Model pre-production radar. The latter aircraft had first flown on May 20, 1988 and began development flying that December. The aircraft was fitted with a mocked-up Sea harrier FRS.Mk 2 cockpit in place of the co-pilots usual displays, and carried an AMRAAM simulator and an underwing AIM-9 Sidewinder acquisition round. The radar's design team's efforts were not lost on the pilots of the FAA. One Sea Harrier pilot later commented: "Making an intercept was simply down to selecting air-to-air mode, pointing the aircraft in roughly the right direction and leaving the rest to the radar!" Coupled with the AIM-120 AMRAAM, which was designed as a successor to the AIM-7 Sparrow, the new missile was lighter, faster and less smoky than the Sparrow. The FRS.Mk 2 would be the first non-US combat aircraft to carry AMRAAMs and in theory the Blue Vixen was able to support up to four AIM-120s simultaneously inflight, although all four targets would have had to remain with the radar's 'gimbal' limits.

Airframe Mods

Changes to the Sea Harrier airframe were deliberately minimised in order to speed the programme along, these were restricted

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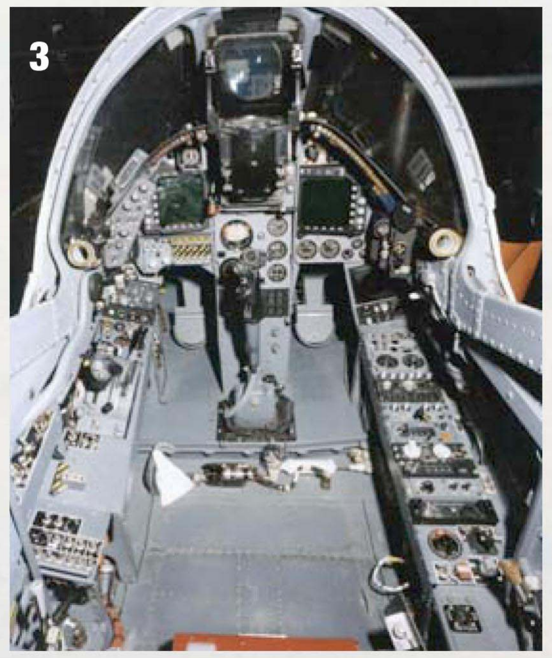

3. The 'new' Sea Harrier's cockpit was dominated by two MFDs and a head-up display with Up Front Controller. While some of the instruments remained the same, they were relocated and in some cases, made smaller to accommodate the new displays. RN via author

MAIN IMAGE. Although superficially similar (apart from the obvious new radome), to the FRS. Mk 1 represented a dramatic leap in capability, especially in the air-to-air role where its radar/missile combination was the envy of many fighter pilots in the West. RN via author

to a new bulbous, blunt radome which necessitated the relocation of the pitot tubes to either side of the forward fuselage. Initially it appeared that two fuselage plugs would be needed both fore and aft of the wing, but after wind tunnel testing only the tail selection was lengthened by 'splicing in' a plug. The original tail units were retained. The wing received minor modifications, with the mid-span dogtooth giving way to a gentler kink, and a new dogtooth added close to the root.

One of the most significant changes for pilots was the improvements made in the cockpit. The FRS.Mk 2 introduced a new Up Front Controller for the HUD, two Ferranti MED 2066 CRT displays, which displaced some instruments, necessitating a rearrangement of the remaining analogue dial instruments, some of which were replaced by smaller, standby instruments. The provision of two multi-function displays (MFDs) allowed the pilot to use the right-hand display for radar data, and the left-hand for a navigation display.

The newer Pegasus Mk 106 engine – a rebuilt and modified engine, powered the FRS.MK 2. The Mk 106 offered a slight increase in thrust and improved thrust at lower operating temperatures, thereby extending engine life.

A New SHAR…

The first FRS.Mk 2 prototype, ZA195, made its maiden flight from BAe's Dunsfold site on September 19, 1988, in the hands of test pilot Heinz Frick. The 40-minute flight began with a conventional take-off and ended with a rolling vertical landing. The aircraft carried a combined pitot probe and test instrumentation boom at the 'point' of the

new radome.

A second prototype, XZ439, joined the flight test programme on March 8, 1989. This aircraft wore a lighter grey colour scheme and had no pitot probe on its radome, instead replying on a pitot head on the lower side of the nose. This lighter colour scheme was destined to be adopted as the standard for the FRS.Mk 2, although a handful of aircraft were delivered in the original darker scheme.

The two aircraft quickly undertook a series of trials, the most intensive of which was a 10-day/76-sortie series of deck evaluations aboard HMS Ark Royal. This took place between November 7-16. During this time the aircraft carried a variety of loads including drop tanks, AIM-9s, AIM-120s and 1,000lb bombs. Trials showed that the aircraft's operating characteristics were a slightly different to those of the FRS.Mk 1 but the new variant was cleared to use the 120 ski-jump.

Under Scrutiny

Despite the success of the trials by 1990 criticism of the programme's spiralling cost which was denied by the then Defence Secretary Tom King, he could not hide the fact that the whole project had risen from £19.8 million to £63.2 million and slipped by 18 months.

Live firings of the AIM-120 by the FRS.Mk 2 had been scheduled for mid-1991 but were delayed due to software problems. It was not until January 1993 the XZ439 arrived at Eglin AFB in Florida to begin the firing trials. Ten AMRAAMs were launched, in a variety of configurations against MQM-107 drones and QF-106 drones. The first lookdown, shoot-down firing was on April 28.

With testing in the US on going, back in the UK the Operational Evaluation Unit (OEU) for the FRS.Mk 2 was formed at RAE Boscombe Down on June 1, 1993 as an offshoot of 899 Squadron. The unit was made up of four senior pilots from the naval air squadron. The OEU received its first aircraft ZD615/723 on June 21 and a second on August 19 (ZE695), which had been the first FRS.Mk 2 to be handed over to the Royal Navy. By September the OEU had a third aircraft on charge.

Yeovilton Ops

The first Sea Harrier FRS.Mk 2 ZA176/716 finally arrived at RNAS Yeovilton for 899 Squadron in September 1993, and the OEU aircraft re-joined those of the training unit, 899 Squadron, at Yeovilton from early January 1994. The new squadron had enough aircraft itself to begin conversion training for the first four front-line squadron pilots in March.

Such was the convoluted conversion process, which could see airframes out of operational service for up to 12 months, that every Royal Navy Sea Harrier, including former development aircraft, were converted to FRS.Mk 2 standards.

It was clear that some 'new build' aircraft would be needed and 18 were constructed at BAe's Brough works, and assembled and flight-tested at Dunsfold prior to being delivered to the navy, the last of which was ZH813 delivered on December 24, 1998 to the navy. Significantly it would be the last 'all-British' fighter produced.

Trials and clearance work continued throughout 1993-94 involving firing of the ADEN 30mm cannon, live AIM-9 firings and another round of ski-jump launches some of which were at night. It was at this time the aircraft received a new designation, changing from FRS.Mk 2 to F/A.Mk 2, with the dropping of the R-for reconnaissance designation.

In September 1994 the OEU detachment of four F/A.Mk 2s deployed aboard HMS Invincible for an Adriatic cruise accompanying

4. A change is coming – a total of seven RAF GR.7s from 3(F) Squadron and nine FA.Mk 2s Sea Harriers from 800 and 801 Squadrons launched from HMS Invincible in the space of 13 minutes, making this the largest ever single launch of Harriers from an Invincible-class aircraft carrier. The gradual stepping up of maritime RAF Harrier operations would help bring an end to the Sea Harrier's operational service and mark the beginning of Joint Force 2000. RN via author. 5. A major milestone was achieved on March 29, 1993 when XZ439 fired the first AIM-120 AMRAAM over the Elgin AFB range in the United States. Ten firings were made during the programme, including launches from both wing and fuselage hard-points. During the trials XZ439 was decorated with a shark's mouth. RN via author. 6. Retaining the overall extra dark sea grey scheme this 899 Squadron example illustrates the early scheme of using a gloss black outline for the 'winged fist' badge on the tail. The bolt-on inflight refuelling probe and dual AIM-9 Sidewinder rails would become standard on the Sea Harriers during the early FRS.Mk 2 deployments supporting NATO operations. All images author's collection unless stated. 7. Despite being relatively new into service, ZA176/716 is already displaying the customary exhaust staining on its lower fuselage that all Harriers are known for. The jet is returning to RNAS Yeovilton after some ACM training, it carries AIS pod on port outer pylon and a drill AIM-9 on the starboard side, the opposition in this case was some RAF ADV Tornados. Note the lack of ventral gun pods. 8. Wearing the later overall medium sea grey scheme XZ455/717 waits for clearance to depart RAF Waddington after some ACM training. Waddington ran the North Sea ACMI range and was home to the annual Exercise NOMAD which saw a number of NATO fighter squadrons regularly participate in large scale air-to-air training. Against French Air Force Mirage 2000s and Swiss Air Force F/A-18 the Sea Harriers were more than a match in the right circumstances. 9. Another Exercise NOMAD, another Sea Harrier FA.Mk 2 loaded with an AIS pod ready for 'combat'. This jet has borrowed s drop tanks from an older FRS.Mk 1 as they are still in the extra dark sea grey colour. Moral among the small band of fixed-wing navy pilots remained high and was demonstrated with the return of full colour 800 Squadron markings to the tail in 2004 during the final year of their service.

six early FRS.Mk 1s from the ship's 800 Squadron.

On The Front Line

With 800 Squadron at sea aboard HMS Invincible, 801 Squadron became the first front line unit to re-equip with the new variant, with aircraft ZA176/000 and XZ455/001 on October 5, 1994. The squadron took its first six F/A.Mk 2s to sea on January 26, 1995 aboard HMS Illustrious, which replaced Invincible on station in the Adriatic for NATO peacekeeping duties following the breakup of Yugoslavia.

Having returned from their last FRS.Mk 1 operational deployment, 800 Squadron began conversion to the F/A.Mk 2 in early 1995, during which the aircraft's designation was tweaked again to simply FA.Mk 2. The squadron made its first Adriatic Cruise aboard HMS Invincible in late 1995, and it was during this cruise that FA.Mk 2s participated in Operation Deliberate Force, mainly flying air defence sorties, but also attacking a Serb ammunition on September 5. During Deliberate Force the Sea Harriers struck three significant targets from what was NATO's overall target list. For this 36 aircraft sorties were flown over nine missions. Over a three-year period 800 Squadron flew 1,784 operational sorties over the Adriatic and Balkans without loss.

A second Sea Harrier deployment to the area by 801 Squadron aboard HMS Illustrious was significant as it was also the first missions flown with AMRAAMs. The first of which took place on December 25, 1995, although the Sea Harrier's new BVR capability was not tested in combat, it was a significant capability to have on side.

Radar Rules Over Bosnia

As the FA.Mk 2 squadrons grew accustomed to the capabilities of their new mount, it quickly became clear that the 'new' Sea Harrier was 'arguably the most capable Fleet Air Defence fighter of its generation' – a view which was shared by all of those who had flown against it. These claims were based around the capabilities of the Blue Vixen radar. During operations over the Balkans, NATO commanders soon came to regard the Sea Harrier FA.Mk 2 as the next most capable airborne radar platform to the E-3 Sentry AWACS. Sea Harriers were occasionally used to plug gaps in NATO's radar coverage, where they proved more than capable of tracking slow-flying low-level helicopters. After one large maritime exercise in 1996 a senior USAF officer commented that the "little Brit jet's radar" is more capable than the US Navy's F/A-18s! When operating in conjunction with the FA.Mk 2's AIM-120 AMRAAMs the partnership was viewed as the most capable BVR capability then in the West.

As the situation across the former Yugoslavia worsened NATO operations stepped up and it was clear to many in the Royal Navy that the FA.Mk 2 would be playing a significant part in supporting the increased NATO presence in the region. Air operations against the Serbs in Kosovo increased with

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10. As an element of 899 Squadron, the Operational Evaluation Unit (OEU) was established in June 1993 to provide operational guidance on the newly introduced FA.Mk 2. Based at Yeoviltion the aircraft, one of which is pictured, were temporarily flown off aircraft carriers to provide a pilot's manual on how to operate the new variant. The three OEU jets wore the newly introduced medium sea grey scheme with an extra dark sea grey radome. Pale pink/pale blue roundels were introduced and were later followed by 899 Squadron's winged fist on the tail. 11. It took some time for the new Sea Harriers to gain squadron markings. In the early days the aircraft simply operated from a pool of available airframes regardless of what pilot was flying the jet. With only white Royal Navy titling on the tail and aircraft code '123' on the intake, this FA.Mk 2 actually belongs to 800 Squadron and carries the serial ZD607 on the ventral strake. 12. The grubby appearance and badly torn 801 Squadron rudder are signs that this Sea Harrier has been working hard. Extra dark sea grey drop tanks were a common sight on the FA.Mk 2s. Of note is the patchy appearance of the rear fuselage and green band around the rear of the IFR nozzle. 13. A key feature of the Sea Harrier's design was its compactness, allowing it to fit on UK carrier decks and lifts without the need for weight-increasing folding mechanisms. Two FA.Mk 2s awaiting the day's flying activities aboard HMS Invincible. Soon the tie-down chains will be removed and the aircraft loaded with practice bombs. 14. Sea Harriers were not known for their noseart or special markings, although a few retirement schemes appeared at the end of their service. But back in February 1998, ZD608 carried six bomb symbols on its nose from operations over the former Yugoslavia. The jet is still fitted with the IFR probe which was standard for Sea Harriers operating as part of the NATO force in the region. 15. In this view the 'sit' of the Sea Harrier is readily apparent, noteworthy is the weight on main under carriage and nose wheel, giving an almost horizontal appearance to the jet as opposed to the normal nose-high static angle. The 801 Squadron markings did not remain intact for very long on ZD615.

Sea Harriers providing air defence for strike aircraft, or carrying out their own missions with 1,000lb or 2,000lb bombs mounted under the wing or a single example on the centreline pylon.

It was during operations against Serbian forces that a propaganda film was released to the media whereby the Serbs, claimed to have shot down a Harrier. The tape was quickly found to be that of an FRS.Mk 1 brought down over Gorazde in 1994. That navy pilot was later rescued by the SAS and evacuated by a French army helicopter.

The Right Decision…

The small number of FA.Mk 2s continued to play a significant role with the Royal Navy and NATO and it was intended to keep the jet in service until at least 2010 by which time is was expected that the first examples of the Joint Strike Fighter (F-35 Lightning II) would be shortly entering service.

In 1998, the Government announced a major change to the Harrier Force, stating that all would come under one unified command known as Joint Force 2000, which would include both RAF and Fleet Air Arm units and provide the ability for both services to operate together from land and sea. The Joint Harrier Force was formed on April 1, 2000, and shortly afterwards part of the unit deployed aboard HMS Illustrious to offer air cover to British ground forces operating in Sierra Leone. The aircraft were used as a visible deterrent in the region conducting countless 'show of force' flights to aggressors in the area.

Despite the combined operations as the F-35 project slipped further and further behind and the costs escalated the British Government was forced to make some painful decision in terms of controlling its Defence Budget – the most significant announcement to come from this was that the Sea Harrier FA.Mk 2 would be withdrawn from service beginning in 2006. The decision was taken on the basis that there would be significant 'difficulties' in upgrading the Sea Harrier's capabilities still further and that modifications to the Pegasus Mk 106 engines, which were then reaching the end of their lives would be prohibitively expensive. The Type 45 anti-air warfare destroyers entering service could now, it was stated, accomplish the capabilities offered by the Sea Harriers.

The decision to abandon the Sea Harrier was purely made on the basis of cost savings as it was expected to save £135 million and that a further £230 million could be saved by not implementing an engine upgrade.

The last operational sortie for the FA.Mk 2 took place on March 28, 2006 801 Squadron performed a five-aircraft flypast over RNAS Yeovilton to mark the premature retirement of the Sea Harrier from British service. The navy was now left without a fixed-wing fast jet in its inventory. As if to realise the political and public fallout of this decision, the aircraft were quickly ferried to RAF Shawbury to be placed in storage away from prying eyes.

The School of Flight Deck Operations based at RNAS Culdrose later used a small number of grounded FA.Mk 2s until 2012.

Bf 109G-6 LATE SERIES 1/48

Written and photographed by Spencer Pollard

HIDDEN GEMS

You find aircraft in the most surprising places…

Last year my wife and I flew to France from Liverpool John Lennon Airport. In order to save on a week's parking we stayed a night in the Crown Plaza hotel and then parked there, the hotel being located in the old Speke Airport building. Along with being an absolutely stunning art deco building and interior, the hotel has a secret: it's also the home to a collection of vintage aircraft…

Around the back of the hotel there is the remains of the old airport hard-stand, which is now the home of the Speke Aerodrome Heritage Group who are in turn, the custodians of a small collection of aircraft including the Meteor F8 that you see here.

Well, being rather inquisitive, I couldn't resist taking a look and snapping a few pictures before we left for the airport. There appears to be eight aircraft on display including a Jetstream, Britannia, Dragon Rapide and Percival Prince. The guys that form the group have worked extremely hard to preserve these aircraft using only charitable donations, good will and hard work!

I'd like to thank them for allowing me to take some pictures last year and would like to direct to the following Web page where you will find more information on the group and their aircraft: http://www.aeroflight.co.uk/museums/main/speke-aerodrome-heritage-group.htm

WH29

Typhoon FGR.4, ZK342, ‘ED’ with No. 6 Squadron at RAF Lossiemouth, 2014. This Typhoon is in the standard grey scheme with the spine and tail fin finished in the unit’s WWII desert camouflage colours.

FANCY FLIERS!

Alan Firbank photographs some of the RAF’s Anniversary colour schemes carried by both the Tornado GR.4 and Typhoon.

For those who enjoy their modelling in a smaller scale, this month there is a lovely sheet of Typhoons and Tornados from Xtradecal, as seen in our decal review. As we think you are going to need all the help you can get with the tiny markings we bring you a selection of photos of the real thing taken at Royal International Air Tattoo, Fairford in 2014 and 2015. Enjoy!

Tornado GR.4 ZA461 with No. XV(R) Squadron at RAF Lossiemouth in 2015. The Tornado is painted overall Camouflage Grey with most of the tail painted Cherry Red and a large squadron’s badge and white lettering. The Cherry Red areas are outlined in Roundel Blue and the Tornado carries small red, white and blue roundels on the nose and wings.

Typhoon FGR.4 ZK353/BQ with No. 29(F) Squadron at RAF Coningsby 2015. A great 100th anniversary scheme on the circuit in 2015 was this Typhoon with a Ruby Red tail fin. The unit’s XXX and bird of prey’s head appears on the fin with letting and white profiles of some of the types flown by the squadron since it was established in 1915. Special markings also appear on the nose winglets.

Typhoon FGR.4 ZK349 GN-A. The special scheme represents a Battle of Britain period Hurricane as flown by Eric James Brindley Nicholson, VC. The Typhoon’s upper surfaces are finished in a pattern of Dark Earth and Dark Green with Hurricane style codes and roundels on the fuselage sides. A normal Typhoon finish of Camouflage Grey is retained on the under sides with large red, white and blue roundels. WWII red and blue roundels are carried on the upper wings.

Tornado GR.4 ZA412 with No 617 (Dambusters) Squadron. The squadron is standing down for a short while so it was a good time to apply a special scheme. The superb tail markings showing the breaching of the dams will produce an outstanding model.

Tornado GR.4 ZA456 with No. 9 Squadron at RAF Marham in 2015. Again the special markings are applied to an overall Camouflage Grey Tornado. The spine and tail fin are pained gloss Black with a large green bat badge on both sides of the fin.

Typhoon FGR.4, ZK308 'TP-V' with No. 29 (R) Squadron at RAF Coningsby, 2014. The standard grey scheme had a set of D-Day stripes applied to commemorate the 70th Anniversary of the allied landings in Northern France.

DELFIN IN DETAIL

Zac Sex brings us an in-depth look at this attractive little trainer, offering modellers plenty of inspiration and features that they can add, to any of the available plastic kits.

Designed and built by the Aero Company of then Czechoslovakian state, the L29 was the first jet engine aircraft produced by this company to see wide-scale production.

The L-29 took to the air for the first time in 1959 and as such would have been a competitor to the likes of the French Fouga Magister and British Folland 'Gnat'.

With the Cold War in full swing, this restricted the international sales market to fellow Warsaw Pact members and third world client states of the Soviet Union. The simple robust design of the L-29 with its conventional layout and ability to take off and land on simple grass airstrips, made it an ideal candidate for many developing nations, but also for training the

Compared to the starboard nose, the port side is relatively smooth. Note the blended shape of the intake.

An East German Air Force L-29 basks in the afternoon sun.

With sunlight bouncing off the nose, the raised panels that form part of the aircraft's construction come into view.

The nose gear is simple and rugged. Note the landing light and its power cable.

The main undercarriage leg. Note the tyre tread and the brake cables running down the leg to the wheel hub.

number of domestic and foreign student pilots who studied in the USSR.

Of the 3500 L-29's that were built in Czechoslovakia 2000 of these were exported to the Soviet Union and many hundreds of others became the standard jet trainer for soviet clients with large numbers turning up in the inventories of the usual suspects such as Iraq, Syria, Egypt, and Vietnam.

Other users of interest were Idi Amin's Uganda, Sukarno's Indonesia, and Nigeria, countries that received varying degrees of Russian aid, but ultimately did not remain in the Soviet sphere.

Although designed primarily as a jet trainer, the L-29 was also capable of being used in recon and

The underwing tanks on this preserved aircraft have seen better days! Adding these dents to a kit tank would add further levels of authenticity.

The tiny navigation light found on the starboard wingtip, blue on this side, red on the other…

The airliner style tail does much to set the character of this aircraft.

There's plenty of detail inside the main gear bay…

…No matter where you look!

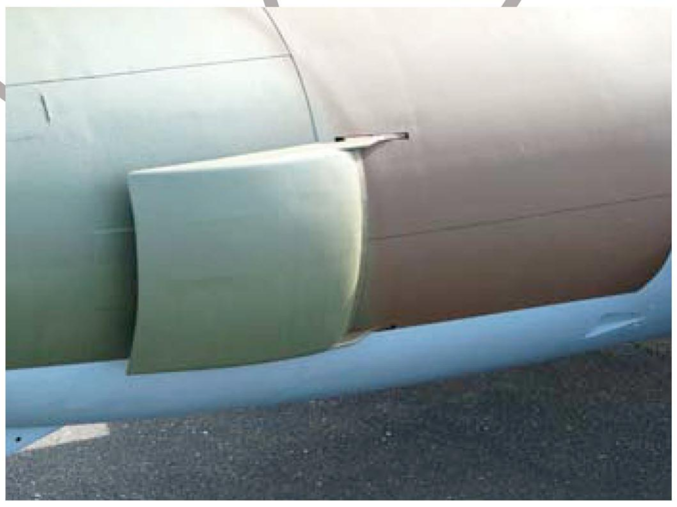
Wing detail. Seen here, this is a well made, smoothly finished, aircraft.

The port aileron. Note how this is hinged slightly behind the front edge which is in turn, raised above the surface of the wing.

Like most training aircraft, this one is tiny!

Tailfeathers. Note the gap between the underside of the rudder and the fin and how the elevators are deflected upwards with the aircraft at rest.

In close up, there are plenty of details to examine, the fit of the rudder, the surface panelling and the rivets, all coming into view.



The airbrakes on the L-29 are a design feature of the aircraft. As you can see, they don't sit flush with the fuselage, there being a distinct gap between each one and the underlying airframe.

The worn wingtip panel and faded camouflage paint looks great on this aircraft. What a mess!

Compare this unrestored undercarriage leg with that seen earlier.

light strike roles. It was in the latter role that the Egyptian air force flew its L-29s in desperation against Israeli forces towards the end of the 1973 war. L-29s and Sukhoi Su-7s launched last ditch efforts to halt Israel's forces as they rampaged behind the Suez Canal, enveloping Egypt's third army and heading towards Suez City. The minimal weapon loads of the L-29 barely made it worth it as the massed .50 Cal machine guns of the Israeli tank crews must have made these flights hair raising for these recklessly brave Egyptian pilots.

Thankfully, today, the remaining L-29s soldier on in the hands of private collectors. Its role as a fine, sturdy jet trainer, having been passed on to the equally outstanding L-39 'Albatross'.

This L-29 is somewhat more dilapidated than our restored example and would therefore be an interesting subject should you fancy building something just a little different.

Note the tail-down sit of the L-29 in this shot.

This three-quarter view of a Russian Air Force aircraft, reveals the look of its overall aluminium paint finish.

The diminutive size of the L-29 can be gauged by the surrounding aircraft, including an Su-27 Flanker, MiG-25 Foxbat and MiG-29 Fulcrum. This would make a superb diorama!

MIRAGE III

More than any other fighter at the time, the Mirage III enhanced the French aviation industry as a producer of high-quality military equipment. It would be no exaggeration to say that the Mirage III took a large share of the credit for the current position of its home country as the world's third-largest exporter of armaments.

A Mirage pilot, wearing a high-altitude pressure suit points out the badge on Mirage IIIC No.01. The exhaust's 'eyelids' can just be seen at the rear of the tail pipe.

Perhaps more than any other aircraft Dassualt's Mirage III symbolised the renaissance of French military aircraft design following the end of World War Two. It was developed to meet a local requirement, but the fighter exhibited qualities which aroused the interest of air forces around the world, which resulted in a steadily flow of export orders. The Mirage III spawned a plethora of sub variants, and founded a dynasty of combat aircraft, the later models of which had little in common with their simple, lightweight forebear except for the famous name.

The Mirage III story began in obscurity, its first step being one of a quest after impracticality. In reaction to what it thought to the air fighting lessons of the Korean War, France's air force (Armée de l'Air) issued a specification in 1953 for a small, light fighter capable of carrying all-weather armament up to

An Israeli Air Force Mirage IIICJ 775 from 117 Tayeset (Ha'Silon Ha'Rishona – First Jet Squadron) sits alert an an undisclosed air base during the late 1960s. Mounted on the outer pylons are AIM-9B Sidewinders, although many Israeli pilots preferred to get in close to the enemy aircraft and use the twin cannons.

60,000ft in a maximum of six minutes. As with other firms which responded to the challenge. The Societé des Avions (later Générale Aéronautique) Marcel Dassualt realised that only a combination of conventional turbojet and liquid-fuelled rocket could meet the time-to-height limit. Thus, when the MD.550 Mystére Delta first took to the in the hands of Roland Glavany on June 25, 1955 powered by two licence-built Armstrong-Siddeley Vipers were intended to be augmented by a detachable under fuselage pack containing an SEPR 66 rocket motor of 1,500kg thrust.

Renamed Mirage I, the stubby delta was soon viewed as being too small for a practical fighter in the European environment. In its final form with 980kg thrust reheated Vipers and rocket installed, it still could not reach the required Mach 2, yet the airframe had served to prove the delta configuration for a larger variant, designated Mirage II. Intended to be powered by two Turboméca Gabizo engines and a pair of thrust rockets this failed to make the transition to metal because the projected maximum speed was only Mach 1.55. At last, the right components were brought together in the Mirage III: a SNECMA Atar reheated turbojet, a fuselage conforming to the newly-discovered area-rule, and a wing profiting from British research with the Fairey Delta 2. Flown by Glavany on November 17, 1956, the Mirage III No.001 was clearly a perfect design.

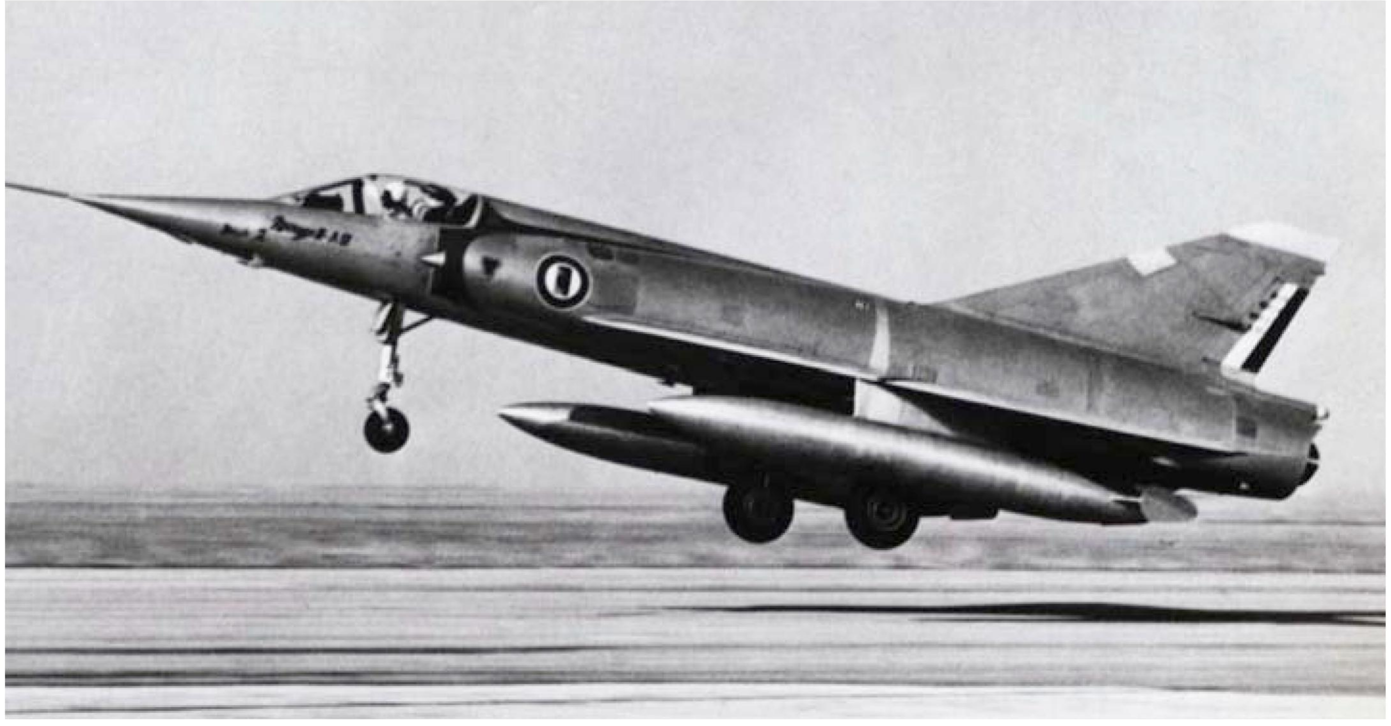
The Mirage III's wide appeal stems in great measure from its tractability. Although regarded at first as an interceptor, it quickly evolved into a multi-role aircraft equally at home undertaking ground attack or reconnaissance missions. Development of the aircraft's weapons systems was assigned to ten Mirage IIIAs ordered by the French government and built in 1958-59. Only one of these had flown by August 1958, when the Armée de l'Air affirmed its faith in the aircraft by placing the first of many orders for Mirages.

Foremost in Dassualt's mind was that the Mirage III was a simple aircraft to operate and maintain but if necessary was able to be upgraded with little fuss over the following years, or tailored to a customer's specific operational request, if the order was large enough.

Dogfighter debut

Dassualt wasted little time in developing the Mirage IIIA, and on October 9, 1960 at Bordeaux-Mérigance; the first production Mirage IIIC flew. Overall it was outwardly similar to the ten pre-production machines, in particular the Mirage IIIA-06, but was slightly longer and fitted with operational equipment. In October 1958, 100 examples were ordered, with deliveries taking place between October 1960 to November 1962. ►

Where it all began, Dassualt had a long history in developing the delta-wing design and this Mirage III No.001 was early development airframes that led to the Mirage IIIC.



One of the ten original Mirage IIIAs, that were responsible of developing the early delta-winged test-beds into viable operational warplanes. The French Air Forces ordered 100 Mirage IIIAs, but later reduced the order to just ten, as focus was shifted to the production model - the Mirage IIIC.

When they entered service with the French Air Force the Mirages retained their natural metal finish, with red trim on just the intakes and occasionally behind the cockpit. The nose radome was matt black.

"The Mirage III's wide appeal stems in great measure from its tractability. Although regarded at first as an interceptor, it quickly evolved into a multi-role aircraft equally at home undertaking ground attack or reconnaissance missions."

A returning Mirage IIIC releases its braking chute after returning from a local training sortie. Of note are the raised flaps and slight deflection on the rudder, pilots had to adjust their techniques due to the higher landing speeds required of the delta-wing.

The load carrying capacity of the Mirage IIIC is laid out for Dassualt's photographer. Among the items on show are 600lit and 1,300lit drop tanks, JL-100 fuel and rocket packs, a Nord AS.30 air-to-air missile and a R-530 missile. Mounted on a stand under the radome are 30mm DEFA cannons, each with 250 rounds per gun.

A pair of Mirages, No.16 and No.89 lift off the IIIC production line depart Dijon-Longvic for a training sortie. The aircraft's entry into service was not without problems, which were mainly due to the advanced radar's reliability.

The Mirage IIIC was a dedicated single-seat interceptor, powered by an Atar 09B-3 turbojet with afterburner; the tip of the exhaust nozzle was fitted with variable 'eyelids'; the air intakes either side of the fuselage retained the shock wedges of the pre-production aircraft; moving them allowed enabled the flow of air into the power plant to be regulated. Gills mounted on the flanks of the engine nacelle opened automatically at low speeds preventing the engine from stalling when the jet was nose-high, these gills brought extra an extra flow of air into the engine.

Armed with with two 125-round DEFA 30mm cannons fitted below the fuselage, near the intakes, the Mirage IIIC was also equipped with three wing pylons (one under each wing, and a central one under the fuselage), to which various extra drop tanks could be attached; as the Mirage's engine was regarded as being quite 'thirsty'!

A short time later, modifications to the airframe meant that the number of pylons increased to five: (two extra under the wings).

Redundant Rocket Pack

In accordance with the early development programme, a SEPR 841 back-up rocket using Triethylamine Xylidine fuel with nitric acid as an oxidant could be fitted under the fuselage, giving 3,000lbs extra thrust for a period of 80 seconds. However, this configuration meant removing the on board armament in order to house one of the fuel reservoirs and therefore not used often. The rocket was frequently replaced by an extra drop tank. The fairing which housed the rocket's exhaust nozzle was replaced by a ventral fin, and later an arrester hook on some airframes.

It must not be forgotten that the Mirage IIIC was intended as a rapid interceptor guided from the ground to face enemy aircraft, so a Thompson CSF 'Cyrano' 1bis radar system installed. However, the radar and its associated navigation suite was sophisticated for the time, despite its relatively short range and no look-down capability.

For the air interceptor role, the Mirage IIIC could was armed with Matra R-511 or R-530 and Sidewinder air-to-air missiles, a maximum of two were carried in the early years.

Operational in France

A total of 95 Mirage IIICs were delivered to the Armée de l'Air who used them for 25 years, both in France and overseas. The Center d'Expéricences Aériennes Militaires was given the task of developing how the new fighter could be utilised and received Mirage IIIC number two in January 1961. This was the first production standard machine intended for the air force. A following 15 examples were delivered which then made up a Mirage 'unit' based at Mont-de-Marsan. It was however, the famous 1/2 'Cigognes', which had been equipped with Mystére IVs, the new squadron now held the distinction of being the first Mach 2 unit equipped with the Mirage in the service. The first 'Cigognes' Mirage IIIC arrived on July 18, 1961. Within a year the squadron was up to full strength with 15 aircraft. But due to a number of technical problems the jets were barley operational on a daily basis, with many of the Mirage IIICs being grounded for days at a time.

Despite these problems, other squadrons were equipped with the new interceptor: 2nd Escadre at Dijon-Longvic, the 5th Escadre at Orange-Caritat, the 10th Escadre at Creil, and the 13th Escadre at Colmar-Meyenheim. These squadrons were looked upon as the 'tip of the spear' within the French air defence system. The jets maintained a 24-hour QRA in defence of the nation's airspace.

Service and Upgrades

The pace of development that Dassualt invested

Wearing the typical natural metal finish with red trim used on early Mirage IIICs, this example No.7 from EC 1/10 'Valois' is pictured after shortly arriving at the Musée Air and Space at Le Bourget, Paris for static display.

A nice profile view of a Mirage IIIC near the end of its operational career. The subtle weathering to the metal finish is obvious as are the tail markings which have been stripped off revealing the clean metal panelling underneath. The variety of colour to the tail fin's leading edge are noteworthy.

in the Mirage III meant that although revolutionary the IIIC was not destined to remain in widespread service for long. The arrival of the improved Mirage IIIE quicker that anticipated meant that squadrons were able to swap their IIICs for the later variant. This process started with 2/2 'Cote d'Oir' which reformed in April 1965 and later became the Escadron de Chasse de Transfomation (ECT in October 1968. Next was 5th Escadre and 10th Escadre at the end of January 1969. This wing was the last to give up its specially modified Mirage IIICs, as 3/10 'Vexin' was based in Djibouti in Africa and only retired the type on August 11, 1988, having received the jets in December 1978.

A total of 100 Mirage IIICs were built of which 95 entered served in the Armée de l'Air, the other five served as prototypes for the Mirage IIIB, IIIR, IIIE and lastly the IIIO for the Royal Australian Air Force.

Export Sales

The Mirage IIIC enjoyed a successful export career, being used by Switzerland, Israel and South Africa: the last two nations used the type in combat and later Dassualt developed versions which answered the needs of the purchasing country.

Switzerland, was the first export customer for the Mirage, which unusually was given a Mirage IIIC which it designated Mirage IIICS. This aircraft later served as the basis for 36 licence-built improved aircraft designated the Mirage IIIS.

Israel bought 72 Mirage IIICJs for its Heyl Ha'Avir (Israeli Air Force) which were delivered from April 1962, the last examples arrived in 1964. The jets were issued to 101 Squadron, which became the first and most successful unit within the Israeli Air Force.

In the beginning, the Mirage IIICJs were identical to the French examples, except they could be fitted with SEPR rockets. Later the air force received American and indigenous equipment before being modified even further over the following years.

The Israeli's were the first to score an aerial kill with the Mirage III when one of its fighters shot down two Syrian Air Force MiG-17s on August 20, 1963. Following the dogfight, the Dassualt fighter was christened the 'Shahak' (Fire from the sky). The fighter went on to be very successful during the Six Day War in June 1967 when the IIICJs confronted Syrian, Jordanian and Egyptian Air Force MiGs, Hawker Hunters and the legendary MiG-21 Fishbed.

After sweeping the the skies clear of the opposition, Mirages went on to conduct countless close-air support missions, strafing Arab armoured convoys and troop concentrations that were advancing towards Israel's border.

The first generation of Mirage IIIs served with 101st, 117th and 119th Squadrons in the final years of their service, but by the beginning of 1975 the aircraft were slowly withdrawn from service with the last examples being retired from front line service in 1979. Despite their 'hard-use' a second-hand customer was found for the aircraft; Argentine bought a number of examples for its air force.

Bush War Bandit

In 1962 South Africa ordered 16 Mirage IIIC, designated the IIICZ. This was after a stunning aerial display which was presented ►

Devoid of stores the Mirage IIIC was an elegant looking aircraft. Such was the pride in the new fighter that the French Air Force organised countless media events to publicise the new jet fighter. A Mirage IIICs scrambles for the assembled press from Dassualt's production facility.

A stunning image of Dassualt's main ramp at Bordeaux-Mérignac sometime in the late 1960s or early 1970s. Mirage IIICs share the ramp with Mirage IIIRs and Etendards.

to a delegation of the South African Air Force at Bordeaux-Mérignac. The IIICZ's maiden flight took place in February 1963, and the first examples were delivered to South Africa in April. The Mirage IIICZs were not very different from those of the Armée de l'Air, equipped with Atar 9B-3 turbojet engines, SEPR 841 rockets and a Martin-Baker Mk4 ejection seat.

Operational with 2 Squadron at Waterkloof AB which were known as the 'Flying Cheetahs' the Mirage IIICZs took part in the air war over Angola where they engaged Angolan Air Force MiG-19 Farmers and MiG-21 Fishbeds.

The aircraft remained in service with 2 Squadron when they moved to Hoedspruit, which operated a mixed fleet of Mirage IIICZ, RZ, R2Z and BZ types in the training role and air defence of northern South Africa into the 1980s. At one time plans were made to upgrade the Mirage IIICZ and issue them to 5 Squadron, a reservist unit at Durban, but this did not take place and 2 Squadron continued to operate the Mirage IIICZs until 1990. This retirement marked the end of 30 years of service for the Mirage IIIC in SAAF service.

But at least one Mirage IIICZ, known as 'Black Widow', No.800/ZU-DME remains airworthy in the skies of South Africa as part of SAAF Museum's heritage flight, the 'delta' is a firm favourite at air shows throughout the country.

African Combat Highlight

The greatest operation that SAAF Mirage IIICZs were involved in was Operation Reindeer in 1979. South African paratroops attacked an enemy base camp in Cassinga, deep behind Angolan frontlines. As the South African troopers were preparing to leave the destroyed facility, a large number of Cuban tanks and APCs attacked the lightly-armed soldiers. Close air support was immediately requested from Mirage IIICZs and Buccaneer fighters, which were providing air cover for the operations. While the Buccaneers attacked the tanks with iron bombs, Mirages strafed up and down the column of APCs, and Cuban and Angolan troops caught out in the open, using their 30mm cannons. ■

Much like the SAAF Air Force the Mirage IIICs that remained in service into the late 1970s were painted in 'Air Defence Blue' camouflage on their upper-surfaces.

Serving with EC 2/10 'Seine' at BA 110 Creil, 10-RC illustrates the later blue scheme, although with a replacement nose section in natural metal. Large squadron badges were standard throughout the early 1980s with the French Air Force. On the centreline is a R.530 air-to-air missile.

Towards the end of their service, South African Air Force Mirage IIICZs received overall low-visibility camouflages in a variety of blues and greys. The same colours would later be used on the Atlas Cheetahs. National insignias were removed or painted over.

Dassualt Mirage IIICZ 800 wears the typical SAAF scheme of the time, sand and green, this particular aircraft would later become part of the SAAF Museum's historic flight and be painted in an exotic black and gold colour scheme – it would be known as 'Black Widow' on the air show circuit.

An early development Mirage IIIC, No.8 is armed with a centreline mounted R-530 missile air-to-air missile. The size of early generation air-to-air missiles is evident, only one could be carried by the Mirage.

The Israeli Air Force found that the Mirage IIICJ's Cyrano radar, were not effective enough and pilots did not use it much in combat, so squadron ground crews simply dismantled them and filled the vacant space in the nose cone with ballast to retain the jet's centre-of-gravity.

REFERENCE FEATURE

THE FEARSOME 'FLOGGER'

Had the Cold War turned hot in the mid-1980s, NATO pilots would have been most worried about the new generation of Soviet fighters that were just beginning to enter service, aircraft like the MiG-29 Fulcrum and Su-27 Flanker. Although these aircraft extremely capable, they were only available in very small numbers, and the backbone of Warsaw Pact air power was provided by the variants of a single family of aircraft, the MiG-23 and MiG-27 Floggers. To this day Floggers remain on the front line. Many in the West rated the Floggers as easy prey for any halfway competent Western fighter pilot, capable of being bettered by every Western fighter from the F-4 Phantom II onwards, this proved to be far from reality.

A Swedish intelligence gathering aircraft photographed this MiG-23MF (Red 12) in its original overall grey colour scheme applied to many IA-PVO Floggers. The hydraulic fluid left from the 'swing-wings' has caused some heavy weathering.

1

2

1. For many years this was how the Flogger was seen in the West, grainy black and white images taken when the jets were intercepted on the borders of the Warsaw Pact. This Russian pilot is flying a fully armed Flogger-G. Note that it has the later wing design with swivelling pylons under the outer wing panels.

2. Stripped of their external pylons and sensitive under nose IR sensor six MiG-23MLs deployed to Finland in 1978 as part of a long-standing exchange programme.

At one time this view did not seem unreasonable, since it seemed to be supported by the combat reports of 36 Syrian MiG-23s downed by Israeli pilots over the Bekaa Valley in 1982, and then two Libyan Floggers shot down by US Navy Tomcats in 1989, the Flogger's reputation was at rock bottom.

These results were more a result of poor pilot training and tactics than what the MiG-23 was capable, it has to be remembered that these were simplified export variants of the aircraft, which lacked any BVR capability.

Fishbed Replacement

Design of the MiG-23 began in the early 1960s, when Mikoyan Gurevich OKB began studies for a replacement for its MiG-21 Fishbed tactical fighter. Aware of the shortcomings of the MiG-21, the Design Bureau wanted to produce a fighter with greater payload, range and firepower, with more powerful sensors to give freedom from the constraints of restrictive ground control intercept (GCI) control. The new aircraft was also to be faster, and faster climbing than the Fishbed. All these would result in a new fighter that would be larger and heavier and would mean increased field lengths and relatively poor take-off and landing performance – the key would be to produce a fighter with exceptional performance with an excellent STOL performance.

In a response to improve the performance of the new fighter, Mikoyan developed the Model 23-01, later designated the MiG-23PD, which was a conventional-looking supersonic design with a fixed delta wing and conventional tail planes, powered by a single main engine of a Tumanskii R-27-300 and two 'sustainer' engines for take-off and landing. These two Koliesov RD-36-35s were located in the centre fuselage and were intended only to reduce take-off and landing speeds. The type was never intended to be able to take-off vertically and after only 14 test flights it was concluded that the aircraft, now named Faithless by NATO offered little advantage over the current MiG-21s then in service.

Typical of Russian practice at the time, another group of engineers within Mikoyan were working on an alternative approach to STOL performance through the use of variable-geometry wing, which could be swept at different angels allowing the pilot to select a low-drag, narrow-span wing for supersonic flight, or a longer-span, high-lift wing for slow speed and for optimum take-off and landing performance. This was examined in extensive wind tunnel testing and with a flying proof-of-concept aircraft, the Model 23-11. Results proved the concept work the project was the highest priority by the Russian Minister of the Aviation Industry, which stated that Mikoyan OKB was to construct a second MiG-23, equipped with a variable-geometry wing. Responsibility for the wing pivot design was assigned to the Rodina OKB engineering works.

Flight Trials

Thanks to the high priority, accorded to it, the 23-11 made its maiden flight on April 10, 1967, in the hands of Alexander Fedotov, who initially flew the aircraft with the wing fixed fully forward at 16o. On the next flight, on April 12, he swept the wings throughout their range, and on his third flew beyond Mach 1.3. In a matter of weeks, he was displaying the new aircraft to the public at Domododevo, where NATO assigned it the reporting name Flogger, although at the time they were unaware which design bureau had designed the aircraft.

The 23-11 was always intended to serve as the prototype for a production combat aircraft, and as such it was armed with four AA-7 Apex missiles under the wing gloves and fuselage. Sometimes AA-2 Atolls were fitted instead for trials work as the 23-11 still had no radar fitted.

Flight trials proved very successful and after 98 flights the prototype as handed over the air force along with two similar prototypes. The air force quickly realised the new type showed ▶

"The introduction of the MiG-23M, with its BVR missiles and radar, more powerful engine allowed the Soviet pilots to develop new tactics and procedures"

Poland received 45 MiG-23MFs, with the first examples entering service in 1981. Early models wore the Russian Air Force overall grey scheme, although this example also has a white exercise band on its rear fuselage.

Czechoslovakia's liberalisation in the 1990s was accompanied by the strengthening of links with other European air arms. Here a MiG-23ML takes off from RAF Boscombe Down following its participation in the static park at the temporary home of the RIAT.

Libyan Floggers were regularly intercepted by the US as its carriers patrolled the seas. Fighters from the Sixth Fleet in the southern Mediterranean photographed this MiG-23MS Flogger-E.

A few years earlier, a US Navy F-4J shepherds a Libyan MiG-23MS away from its carrier battle group. Both aircraft are fully armed but there were established international 'interception rules' that needed to be followed.

◀ great promise, with the aircraft capable of taking off within 320m, and having a landing run of just 440m. These distances more than meet the original STOL requirements.

On the strength of the successful flight trials the air force ordered three 23-11 prototypes, which were designated the MiG-23S, (MiG-23 was the air force designation for the Mikoyan Model 23-11). The production aircraft was intended to have the Sapphire radar (hence the S suffix) and a more powerful engine. However, development did not progress without problems, and while the more powerful R-27F2M-300 afterburning engine was ready, the radar was not. Accordingly, the RP-22 radar, known by NATO as Jay Bird, and similar to that fitted to the MiG-21S was adapted to fit the new interim fighter variant. The visual difference was minor but the loss of capability was profound. In a single stroke the MiG-23 was incapable of carrying AA-7 Apex missiles, and therefore lacked any BVR capability. The MiG-23 was reduced, for the time being, to carrying a semi-active, radar-homing version of the AA-2 Atoll, along with an IR-homing variant.

The first production variant of the MiG-23S made its first flight on May 28, 1969. The fifth aircraft had fit the interim radar fitted with very few problems. A batch of 50 MiG-23S aircraft was built between mid-1969 and 1970, after which production switched to the MiG-23M, which first flew in June 1972.

The MiG-23M (the M suffix merely stood for Modified) was the first definitive version of the MiG-23 family, since it was equipped with the intended S-23D-ch Sapphire (NATO High Lark) radar.

With the introduction of the High Lark, the MiG-23 was able to dispense with the ageing AA-2 Atoll, and was able to carry the AA-7 Apex, with two versions normally being carried: one IR-homing and one semi-active radar homing. These would be rippled-fired to increase the likelihood of a hit.

Improvements To A Legend

Experience with the MiG-23S, led to a host of improvements, which significantly changed the appearance of the basic aircraft. NATO allocated the new variant the Flogger-B, with the Flogger-A being designated to the MiG-23S and 23-11 prototypes. The new MiG-23M was fitted with an autopilot, as well as a new sight and ranging system. Most obvious external change was the addition of ribbed airbrakes and the installation of the new engine the Khatchatourov R-29-300, with variable throttled reheat. This dramatically improved performance, and made the MiG-23 a 'hot' fighter by the standards of the day, where as the early MiG-23S was 'sluggish' and disappointing in its performance. Along with the new engine were modifications to the wing. This featured a new extended leading edge, which gave a significant leading-edge 'dogtooth' towards the wing glove. The horizontal tail planes were moved aft, which left a large gap between the trailing edge and tailplane leading edge. This increased control authority and reduced stability, which made the Flogger more agile in pitch. The rear fuselage looked significantly different, as the jet pipe was reduced in length.

Floggers To The Front Line

The introduction of the MiG-23M, with its BVR missiles and radar, more powerful engine allowed the Soviet pilots to develop new tactics and procedures. Firepower was improved further with the introduction of the AA-8 Aphid, short-range IR-homing missile in place of the Atoll, these were often mounted on twin-rail mounted under the fuselage. During the late seventies, Floggers were rolling off the production line at up to eight aircraft a week. Many of these aircraft went to Frontal Aviation for battlefield air superiority. They were the first Soviet fighters with a look-down/shoot-down capability. The aircraft operated in fours, flying under strict ground control to make slash attacks on enemy fighters and low-level bombers. The Floggers has a secondary ground-attack role, using unguided bombs and rockets. Substantial numbers of MiG-23Ms were also delivered to the IA-PVO, where the supplemented

MiG-21s and Sukhoi Su-15/21 Flagons in the air defence role.

The success of the MiG-23M, particularly in VVS service, led to a demand for an export version of the aircraft; in fact, two down-graded export derivatives of the MiG-23M were manufactured. The first of these was the MiG-23MS, which was designated the NATO reporting name Flogger-E. By comparison with the MiG-23M, it differed by having an RP-22 radar and AA-2 Atoll missiles, but lacked the AA-7 Apex capability. In many respects this Flogger was no better than a late-mark MiG-21, but the prestige of operating a 'swing-wing' Russian fighter accounted for the type's popularity with Third World air forces.

The other export version of the aircraft was the MiG-23MF, which retained the Flogger-B reporting name, which was supplied in large numbers to a host of Warsaw Pact nations. Retaining High Lark radar, the MiG-23MF differed from the MiG-23M in detail only. The first examples were delivered to Bulgaria in 1978, followed by East Germany, Czechoslovakia, Poland, Romania, Hungary, Syria, Angola, Iraq and India.

The Need For A Trainer

During the Flogger's development, structural failure during a test flight on March 14, 1972 was traced to the wing root pivots and a leak in a fuel tank. New mechanical processes were introduced during construction along with improved quality control methods. The crack in the wing root had been caused by high g manoeuvres, the Flogger being rated to 8 g, but orders were issued for MiG-23S models to be limited to 7 g. Despite the attrition rate steadily increased and at one stage was so high that the Flogger gained a reputation similar to that of NATO's F-104 Starfighters.

It had always been intended to develop a two-seat version of the MiG-23. The development of the aircraft was first authorised in May 1968. Designated by the air force as the MiG-23UB (Uchebno Bitva, or combat trainer), the two-seater was designed from the start for both pilot training and for weapons training and operational use. Since the two-seater had no Sapphire radar, a separate guidance and illuminator pod had to be provided to allow the aircraft to fire AA-7 Apex missiles, and this was fitted below the starboard wing root, on the leading edge.

Other changes to the two-seater included the reduction of internal fuel capacity and the replacement of single-slotted trailing-edge flaps with twin-slotted flaps. All trainers were equipped with a number three wing, which reintroduced leading edge slats, and allowed the carriage of three external drop tanks. The rear cockpit was fitted with a retractable periscope to give the instructor a better view over the nose, and the head of the pupil, on take-off and landing.

Production of the MiG-23UB continued until 1978, and the aircraft remains in limited use with a few examples being retained as squadron 'hack' aircraft. For student's conversion to the MiG-23 Flogger was relatively simple as the cockpit layout was similar to the MiG-21's, and handling techniques in the pattern were similar.

Upgrades…Upgrades…

The MiG-23 family has always the subject to constant upgrading, and by 1976 a new fighter variant was ready for production and service. Designated the MiG-23ML by the Russian Air Force, the new aircraft was developed from the Flogger-B, but featured improved aerodynamics, avionics and other systems associated with improving capability and performance. The MiG-23ML was the first production variant to take advantage of a host of improvements designed by Mikoyan to provide better handling qualities, particularly at high-angles-of-attack, to improve manoeuvrability, to increase g limits and to improve combat capability.

The airframe of the MiG-23ML, was lightened by removal of the fourth fuselage fuel tank (added to the MiG-23M). This improved directional stability and allowed removal of the dorsal fin fillet and a reduction in side of the folding ventral fin. The opportunity was also taken to install the Khatchatourov R-35-300 turbojet, equipped with afterburner.

The MiG-23ML's navigation system was redesigned and the Sapphire radar received a host of improvements gaining a new dogfight mode, an improved display and easier switchology. The ageing IRST was upgraded becoming the TP-23M. This required enlarging the IR fairing below the nose. On the new variant the SRO-2M 'Odd Rods' ITT antennas were moved aft, and the AoA vanes and some air-data probes were relocated. The new RWR fairings were added to the rear fuselage, ahead of the ribbed airbrakes.

Despite the many improvements, tactics remained unchanged, although the VVS began to place greater emphasis on autonomous action in the close-in engagements that occurred if or when targets survived the initial BVR engagement.

No exact date for the maiden flight of the MiG-23ML is known, but it was certainly during 1976, the same year the aircraft entered its five-year production plan. The new variant made its public debut in 1978, when a six aircraft detachment from Kubinka, Moscow, led by Lieutenant Colonel Belenkov, visited Finland as part of a long-standing squadron exchange programme. These aircraft were stripped of external pylons and did not carry the sensitive under nose IR sensor. Observers at the time mistakenly concluded that these aircraft were a new downgraded expert version of the MiG-23, assigned the NATO reporting name Flogger-G.

Exported But Not Excellent

The Flogger-G was exported to North Korea in late 1984, then to Czechoslovakia and East Germany, where the new variant partly replaced and partly augmented existing Flogger-Bs. The MiG-23ML was, in 1981 when production ended, the last major MiG-23 fighter variant, although it served as the basis of the later MiG-23MLD conversion. Flogger-G saw action in Afghanistan with the Soviet Air Force. One regiment, some 45 aircraft, was deployed to Kabul and later Bagram during 1986 and 1987. The Floggers served exclusively in the ground-attack role, with the likelihood that the MiG-23ML's performance capabilities in the strike roll were being evaluated at the same time.

Further Flogger variants the MiG-23MLD were developed, but were not new builds, these were conversions based on the airframe of the MiG-23ML. The new variant offered improved handling, new leading edges to the wings, chaff/flare dispensers with automatic actuation by the RWR system, swivelling pylons under the outer ►

Wearing the later style Hungarian Air Force 'arrowhead' on its tail fin, this MiG-23UM is painted in the locally applied sand and drab camouflage. Note that open airbrakes at the rear of the fuselage.

Near the end of their operational service the Czech Air Force wore a wealth of elaborate schemes including this Tiger Meet inspired MiG-23ML.

MiG-23UBs served with every MiG-23 and MiG-27 unit in the Soviet air forces including those in the IA-PVO, and with most MiG-29 and Su-27 regiments too.

The MiG-23UBs became the equivalent of the MiG-15UTI Midget of the 1980s and 1990s, having become a great all-round hack and trainer. Most were painted in the standard green and brown Frontal Aviation camouflage.

One hundred and forty MiG-23BNs were delivered to the Czech Air Force, with the first arriving in 1979. Many served with the 28th Fighter Bomber Regiment at Caslav, Headquarters unit of the 34th Fighter Bomber Division. In the final years of the Cold War these Floggers would have been expected to attack NATO troops concentrations and armoured formations.

wing panels, which allowed the wings to be fully swept even when these pylons were being used. A helmet-mounted sighting system for the pilot, similar to that used on the Fulcrum and Flanker was also introduced. NATO designated the model the Flogger-K. With these improvements the jet was now also able to carry the new generation of Soviet missiles; the AA-10 Alamo and AA-11 Archer.

Reach Out And Touch Someone…

Archer AAMs marked a tremendous leap in capability for the Flogger. Finally, the aircraft had an all-aspect capacity, the AA-11 having control fins fore and aft and a vectoring rocket motor nozzle allowing incredible agility for the time. Many analysts believed that with its five-mile range and 33lb warhead the missile was better than the West's AIM-9 Sidewinder.

This armament when combined with the Flogger-K, which could also carry the AA-10 Alamo marked even greater increase in capability since the missile had a genuine BVR fire-and-forget mode.

At the time the West was desperate to find out the true number of early generation MiG-23s that were being converted to Flogger-K, the type was viewed by those within the intelligence community, with the same amount of fear as early generation MiG-29s then entering service.

Elements of the upgrades used in the Flogger-K were incorporated, amongst MiG-23Ms/MFs and even MiG-23Ps, but none were as capable as the MiG-23MLD variant. None the less Mikoyan continued to develop the 'fighter' Flogger in an effort to ensure the type was at less equal to the new generation MiGs then entering service in the late 1980s.

Counting By Numbers

While many of the Floggers that entered service with the Soviet Air Force and its client states were dedicated air interceptors, many did have a secondary ground-attack role from the outset. It was simply looked upon by those operating the new 'swing-wing' fighter as a minor role, that other types within their inventory could fulfil.

But for MiG, when looking at the West's SEPECAT Jaguar and Northrop F-5 saw the potential that these 'cheap' strike aircraft offered and set about modifying the Flogger design to a supersonic ground attack aircraft. Despite sceptics within the air force, viewing the entire project as a waste of time, the new MiG-23B was a minimum change version of the MiG-23S. The main modification was to the forward fuselage. Dispensing with the Sapphire radar, and replacing it with a less bulky PrNK Sokol 23S navigation and attack system, Mikoyan designed a more slopping-nose allowing the pilot a much better view forwards and downwards. The nose shape was distinctive, and quickly led to the new aircraft gaining the nickname 'Duck Nose'.

A new engine was selected, optimised to operate at lower altitudes, the Lyul'ka AL-21F-300. In reality the new attack aircraft was the rear fuselage of a MiG-23M, with the same shortened tailpipe and rear-located tail plane with the No.2 wing.

Battlefield Mods

Specific modifications for the low-level, ground-attack role included the provision of scabbed on armour plate next to the cockpit, and inflammable fuel tanks using an inert gas. Armament focussed on bombs ranging in weights from 100 kg to 500 kg carried on hard points on the fuselage and wings.

Only 24 examples of the MiG-23B were built, before production switched to the MiG-23BN. This latter variant differed by having an improved navigation suite and the same engine as the MiG-23M. NATO assigned the reporting names Flogger-F and Flogger-H respectively.

However, in Russian service the MiG-23BN proved a disappointment, and was widely exported to client states, with at least two airworthy examples finding their way to the USAF (see separate panel) at Area 51.

Further variants of the basic MiG-23BN were also coded Flogger-H, but were designated MiG-23BM, MiG-23BK by the Soviets. The MiG-23BK was similar to the MiG-27K, sharing the same basic navigation suite and avionics. These later MiG-23s used many weapons intended for the MiG-27 and were used as 'force multipliers' within an attack force.

Operationally, aviation critics dismissed the Flogger as a typical low-tech massed produced fighter for the vast ranks of the Warsaw Pact. But is wasn't until nearly two decades later when the Israeli Air Force received a MiG-23ML Flogger-G, on October 11, 1989 from defecting Syrian Air Force pilot Major Adel Bassem when he landed at the small civil airport at Megido in the north of the country that a 'true assessment' of a MiG-23 could begin. It was found that the MiG-23ML's performance was better than Israel's front line F-16s at the time. What the Flogger's lacked were pilots who were allowed to use their own initiative in a dogfight and not be tied to ground control intercept GCI radar facilities on the ground. Unbeknown to the West, NATO had a right to 'fear the Flogger'.

USAF Floggers

Between 1977 to 1988 the 4477th Test and Evaluation Squadron operated up to ten variants of MiG-23BN and MiG-23MS within the vast Tonopah Test Range in Nevada as past of the Constant Peg programme. The 'Red Hats' lost two MiG-23s during testing. While the full details have not been fully declassified, the MiGs were covertly flown against selected USAF fighter squadrons during exercise Red Flag, additionally specially selected USAFE squadrons deployed to Nellis AFB, Nevada to 'fight' with the jets. None of the MiGs undertook weapons trials or fired missiles during the secret programme. It is a testament to how classified Constant Peg remained within the USAF and USN in that countless fighter pilots flew against the MiGs and passed on what they had learnt to squadron colleagues in the in their squadrons, but no security leaks were ever uncovered. ■

A MiG-23MLD Flogger-K wears the final camouflage scheme for the aircraft, which was applied in a completely random pattern – no two aircraft matched, even on the same regiment. The Flogger is armed with an AA-7 Apex under the wing and AA-8 Aphids on the fuselage hard points.

Bulgaria received the MiG-23BN to replace the ageing MiG-17s the first examples were delivered in 1977. A second delivery was made in 1980. The MiG-23BNs were seen as an elite unit within the air force.

Rare for a MiG-23UB, (Red 22) is not carrying any external drop tanks as it taxies out for a local training flight. The ventral fin is folded neatly away and was sequenced to extend down as the undercarriage is raised.

After re-unification a handful of former East German Floggers were evaluated at Manching, the home of testing for the Luftwaffe. The German MiG-23s were all painted in a three- or four-tone brown and green camouflage, with duck-egg blue and grey undersides. This MiG-23ML wears a small German flag on the tail.

This Syrian Flogger-G was extensively evaluated by Israel after its pilot defected. It is seen here in joint Israeli and Syrian markings flying in formation with an F-16I Sufa.

THE JET AGE MUSEUM

We visit a wonderful collection of Gloster aircraft in Gloucester!

The Jet Age Museum in Gloucester is one of the UK's best kept aviation secrets. Home to a wonderful collection of Gloster-built aircraft, both original designs and those built under licence, it's well-worth a visit. Open weekends and bank holidays during the year from 10am until 4 pm, the visitor will find much to enjoy; from a collection of various Meteor aircraft, through the incredible Javelin and on to such delights as a Gamecock and Gloster-built Hurricane, there is much to admire.

This issue includes a full build of the new Airfix 1:48 Meteor F.8. It was the Jet Age Museum's aircraft that Airfix measured and scanned. When the aviation world wanted to celebrate Frank Whittle's achievements with a replica of his E28/39, three full-size aircraft were created, the third and perhaps most impressive is now part of this collection. Do you want to see part of one of the oldest surviving British jets? The Jet Age Museum's cockpit section from Meteor EE425 is the fourth oldest ▶

XH903

MUSEUM DETAILS:

The Jet Age Museum - Meteor Business Park, Cheltenham Road East, Gloucester, GL2 9QL. Tel: 01452 260078
More information about their collection is on their website: www.jetagemuseum.org/Home.aspx
Up-to-date news is on their Facebook page: 'The Jet Age Museum' and onTwitter: @JetAgeMuseum.

surviving British jet, only the Gloster E28/39 in the Science Museum, the Meteor prototype DG202/G at the RAF Museum Cosford and the cockpit of the Science Museum's stored Meteor F.3, EE416, being older.

This is a fine collection of exhibits that offers a fascinating insight into the work of Gloster through its time as a famous builder of excellent aircraft. The museum, though small, is well laid out, all of the aircraft being easy to examine and photograph. Within the hanger the work of the dedicated team of restorers is easy to see, each aircraft looking well preserved and cared for. Outside, the aircraft are less pristine, but no less interesting, the Meteor T7 and NF14 being particularly pleasing.

Along with the aircraft, visitors will also find a dedicated team of volunteers who are keen to chat to anyone about the aircraft on display. During my short time there, not only was I given access to their Harrier T.2 nose section for a future build, two of the chaps spent time talking enthusiastically about the Whittle replica and their work on the Hurricane replica and its colours and markings, both of which are stunning! It was all very enjoyable and testament to the drive and determination that these people have to create the best museum that they can.

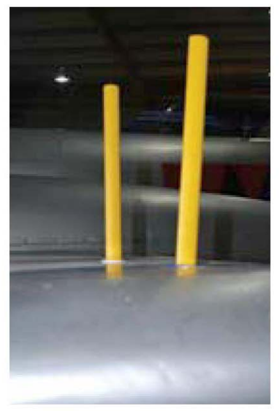
If you have a fews hours to spare I would more than recommend that you visit the museum. I only had a few hours there because I was on my way with my wife to visit friends in the Cotswolds - if not, I'd have spent way more time learning more about this fascinating museum.

My thanks go put to everyone that helped me out with the photographs of the Harrier nose and for asking the many questions that I posed during my visit. Thanks everyone! ■

IN DETAIL

When Airfix decided to recreate the Meteor F.8 in miniature, they visited to Jet Age Museum in Gloucester to scan and measure their stunning example. And what a wonderful job they did, as well! All go the details on the real aircraft are present and correct, but more importantly, the surface textures that you can see on the museum's aircraft, are present on the kit; ripples, fasteners, panels and the like, are there for all to enjoy.

We are delighted with the help of the museum staff, to bring you some detailed pictures of the real aircraft so that you can see how it should really look. We would like to thank the staff for their assistance and would suggest that if you are in the area, you take a trip to the collection - you certainly won't regret it (as our separate feature in this issue, more than shows!).



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WRITTEN BY ALAN FIRBANK

ROYAL INTERNATIONAL AIR TATTOO 2016

The Luftwaffe's Cyber Tiger Typhoon with a complicated paint job applied for the NATO Tiger Meet earlier this year.

The Royal International Air Tattoo seems to roll around more quickly each year. It was held a week earlier than usual but it felt more like a month. Sadly, the event was held on the same weekend as Flying Legends at Duxford so many of us had to choose one or the other.

Following a couple of aborted attempts in previous years, we finally saw the F-35, the future of the RAF and the Royal Navy as far as aircraft is concerned. The RAF, USAF and US Marine Corps brought three examples each of the F-35A and F-35B, making their noisy debut over the skies of Gloucestershire more than a week before the show. The F-35 maybe has a minute radar signature but you can hear it coming a mile away, quiet it ain't!

As well as the F-35s, the USAF brought a pair of F-22A Raptors that made a welcome return to the flying programme after an astonishing gap of five years – was it really that long? Participation from far away places was impressive with a C-130E from Pakistan, a CP-140 Aurora from Canada, Japan's KB-767J and large transports from Australia and New Zealand. More local air arms were represented in numbers with Germany's contribution most impressive with several aircraft wearing the 'new' Luftwaffe's 60th Anniversary markings. Amongst them, the Luftwaffe's brand new A-400M. For some, the pair of immaculate F-4E Phantoms from Greece was worth the ticket price alone.

The English summer weather continued to be less than impressive with strong winds from time to time and heavy rain on Sunday morning, wiping out a couple of early demos. The Patrouille Suisse kept the crowd amused by performing a display on the runway on Sunday morning, in the rain. Having prepared their aircraft, they were determined to put on a show. They taxied along the length of the runway in single file and then returned in 'formation', lifting the dampened spirits of the sell-out crowd… ▶

This 'new' Luftwaffe 60th Anniversary scheme on an EF2000 Typhoon was impressive. A German spectator said to me that the Luftwaffe was amazing with paint!

The French Air Force Rafale C performed an impressive display at Fairford.

The Frecce Tricolori always put on an impressive show. Their newly applied colour scheme on their AT-339As looks impressive too.

One of the Greek Air Force's F-4E Phantoms departs from Fairford after spending the weekend in the static display. A shame they were not included in the flying programme.

A pair of Mirage 2000Ns performed their final displays as Ramex Delta at the RIAT. The colourful one of the pair, celebrates the connection between the French and American air forces in WWI. Mirage 2000s are being retired over the next two or three years leaving Rafale as France's only fast jet in Air Force and Navy service.

One of the F-35B Lightning IIs wearing RAF roundels noisily demonstrates the types hovering capabilities. The large upper fuselage door is open and the lift fan is working hard while the jet pipe at the back is rotated downwards. Two small jets under the wings provide lateral stability.

The complicated arrangement at the back of the F-35B can be seen as the aircraft hovers for the FRIAT grandstand audience.

The F-35B just about to settle on the specially prepared area by the hangars at Fairford.

A US Marine Corps F-35B makes a noise departure from the runway at Fairford in a clean configuration.

The Patrouille Suisse F-5Es depart Fairford on Monday morning headed by a Swiss Tiger in special markings. This Tiger had been 'hiding' on the north side of the airfield all weekend.

It was good to see this old T.5 Jet Provost again. After the Shoreham disaster last year, British classic jets are few and far between at the moment.

Welcome newcomer to RIAT was a team of seven PC-9Ms from the Croatian Air Force. With some minor mods, this scheme would look good on an RAF Tucano.

The MiG-29A of the Polish Air Force was a close contender for the loudest display at this year's RIAT.

The Luftwaffe's new A-400M travels along the north taxiway, preparing for its journey home.

A German Air Force Tornado IDS heads for home after RIAT 2016. Note the fresh 60th Anniversary markings on the well-weathered finish.

No. 41(R) Squadron's FGR.4 Typhoon in 100th Anniversary colours departs RIAT after spending the weekend on static display.

Another of RIAT's historic formations in less than favourable conditions. This one is to demonstrate RAF fast jets, past (The Red Arrows), present (a pair of Typhoons) and future (the F-35 Lightning II).

With its impressive tail artwork, this Pakistani Air Force C-130E sets course for home.

The Royal Navy's impressive "Blackcat" demos in the Lynx have faded into history, replaced by the Wildcat HMA2 making their first appearance at RIAT 2016.

One of the F-22A Raptors squeezes the moisture out of the air during its dynamic flying display at RIAT.

Attempts to fly a USAF Heritage Formation failed on all three days at RIAT. Firstly, the Mustang was grounded by strong winds, then the Raptor broke down on another day. On this occasion the USAF F-35A and F-22A performs a great pass along the Fairford crowd-line.

REFERENCE FEATURE

SU-33 SEA FLANKER

Model Airplane International examines the development of the Sukhoi's Sea Flanker the highly impressive Su-33.

By the mid-1970s the Russian Navy was struggling to develop the Yakovlev Yak-38 Forger into a viable operational carrier-based fighter. Unable to fulfil its intended role due to a lack of range and payload, the entire carrier development programme known as Navy Project 1143 was being called into question. Unlike the West, Russia was failing with its VTOL Forgers and the aircraft, although having the distinction of being the Navy's only carrier-based fixed-wing combat aircraft, was little more than capable of providing local combat air patrols (CAPs) close to the fleet. A result of this failure was that Russian admirals had failed to receive recognition from the Kremlin, when they finally did the navy was keen to expand its surface fleet and wanted aircraft carriers to rival those of the US Navy. A classified assessment study of proposals and ship designs were reviewed under Project 1160. These carriers would be bigger, have a larger air wing and operate much like their US Navy counterparts. It was envisaged that the air wing would consist of modified MiG-23 Floggers and Su-24 Fencers, but prior to any steel being cut the entire project was abandoned due to its estimated cost. Within days, engineers and design staff

'Red 66', a Su-33 from 279th OKIAP accelerates down the flight deck of the Admiral Kuznetsov during testing trials. The aircraft wears the old style Russian Navy flag below the cockpit.

Armed with two R-27 air-to-air missiles (NATO reporting name Alamo), is held back by deck wheel blocks prior to running its two AL-31F turbofans engines. The Russian Navy never adopted the catapult and bridle method for its carriers.

One of the largest ship-deployments for 279th OKIAP saw five of its aircraft aboard the Admiral Kuznetsov in 2011 for the ships Mediterranean cruise. Of note the different coloured 'bort numbers' consisting of blue and red, which designate the two squadrons within 279th OKIAP.

Sailors from the US Navy are shown around the flight deck of Admiral Kuznetsov and a Su-33, in early 1996. Such acts of good will today are now consigned to history.

On the port tail fin is the 279th OKIAP Squadron Two badge, which is a tiger's head, which it is, believed is a hint at the fighter's place of birth, far eastern Russia, where tigers roam free in the wild?

The sheer size of the Sea Flanker is demonstrated 'Blue 109' as it is moved onto one the carrier's lift. via Russian Navy

The Su-33 fleet has received modest upgrades over the years; much of this has focussed on the aircraft's radar and electronic warfare systems. via Russian Navy

shifted their attention to Project 1153, a scaled down carrier which would be able to operate navalised Su-25 Frogfoots and MiG-23Ks and Su-27K Flankers, but once again funding was not secured. The Soviet Navy determined to have its own carrier proposed a fifth and larger designer, known as Project 1143.5, this would have an air wing of Yak-141s, MiG-29Ks and Su-27Ks (K for Korabelnyi, ship-borne), which would be able to take off from a ski-jump ramp mounted on the front of the flight-deck. This design was finally approved, and while the Black Sea Shipyard begun work on the first of four of carriers, senior Russian Naval Aviation chiefs started working with Sukhoi and MiG on modifying their respective designs for maritime carrier-based operations.

It's worth noting that the 'carrier' designs were referred to as 'heavy aircraft-carrying cruisers' within the ship design bureau, due to their heavy surface-to-surface and surface-to-air armament, this was also a way around an international treaty, which prohibited aircraft carriers sailing through the straits of Bosporus and Dardanelles off the coast of Turkey.

The combination of both the Fulcrum and Flanker aboard a carrier, was viewed in many ways as following the US Navy doctrine of having the Tomcat and Hornet, one for long-reach interception missions - defending the fleet, the other a lighter fighter and multi-role attack aircraft. For the Russian Navy, their new Flanker needed to be as good as, or better than the F-14 Tomcat.

Sukhoi had already established itself a reputation with the Su-27 Flanker, which fulfilled the role of a long-range, all-weather air superiority fighter in the air force.

Design studies for the Su-27K begun in 1978, and on 18 April 1984, the Soviet government instructed Sukhoi to begin work on the air defence fighter, which would be known as the T-10K under the guidance of Konstantin Marbyshev. Nikoalai Sadovnikov was appointed the design bureau's Chief Test Pilot for the programme. By late 1984, conceptual design studies had passed critical review and within two years a detailed design had been finalised. Two prototypes, T10K-1, T10K-2, built by the Sukhoi works in Moscow and were followed by seven pro-production aircraft T10K-3 to -9 built at Komosomolsk-on-Amur in 1990-91. These were followed by 26 early production models, which were delivered to the Russian Navy.

Major Mods

Adapting the original Su-27 for maritime operations required Sukhoi to incorporate a reinforced fuselage and undercarriage, with long stroke absorbers and twin nosewheels, to withstand the greater stresses experienced upon landing, particularly during non-flared landings (this is where the aircraft does not assume a nose-up attitude prior to touchdown). Enlarged leading edges, flaperons and control surfaces increased lift and manoeuvrability at low speeds, although the wingspan remains unchanged. The wings featured double-slotted flaps and outboard dropping ailerons. The refinements to the wings increased their total area by 12%. Due to the size of the aircraft, the wings and stabilators were modified to fold in order to allow the aircraft to be accommodated below deck. The radome could be raised and the tailboom folded to reduce the overall length of the aircraft.

Two modified AL-31F Series 3 turbofans, with emergency after-burning, as well as anti-corrosion protection were installed along with an inflight refuelling probe, mounted on the port side of the nose would allow the Flanker to range far from the carrier and intercept any threat far from the fleet. The new model was equipped with canards to decrease the aircraft's angle of attack when taking off and landing and an arrestor hook added which replaced the drag chute, used on land based Flankers.

A Troubling Start

The first flight of the Su-27K prototype (T10K-1) occurred on 17 August 1987 in the hands of Viktor Pugachov. On 1 November 1989, the first landing was made on board a ship.

From December 1995 to March 1996, the Admiral Kuznetsov sailed on a short work-up cruise in the Mediterranean Sea, carrying to Su-25UTG Frogfoots, nine Ka-27 Helix anti-submarine warfare helicopters and 13 Su-27Ks.

Aware that they were developing a completely new model of the Flanker, Sukhoi proposed a host of 'paper ideas' to the Russian military, which included the Su-27MK multirole variant, Su-27KRTsreconnaissance and target indication aircraft and the Su-27KPP electronic warfare aircraft. Only one non-standard aircraft was constructed, the Su-27KUB (Uchenbo-Boyevoi, combat trainer), also known as the T-10KUB or Su-33UB. This was a side-by-side two-seat multirole fighter with Phazotron Zhuk radar, converted from the T-10K-4 test aircraft. The Su-27KUB made its first flight on 29 April 1999; on 6 October 1999 it landed for the first time on the Admiral Kuznetsov. A production line was prepared by ▶

KNAAPO at Komsomolsk Na Amure. A short time later the programme was cancelled.

On 31 August 1998 the Su-27K was officially commissioned into service with the Russian Navy with the 279th Naval Fighter Regiment of the Northern Fleet based at Severomorsk-3, and received the official designation Su-33 (NATO - Sea Flanker), so distinguishing the aircraft from its similar looking air force partner.

But the fate of the prototypes was less then guaranteed. When the Soviet Union collapsed, two of the test aircraft T10K-3 and -7 remained in Ukraine; the T10K-7 was sold to China in 2004 and used as a pattern for the Chinese J-15 carrier-borne fighter. The collapse of the country also brought the cancellation of a host of shipbuilding programmes which included the new carriers Varyag, Oryol and Ulyanovsk – the knock on effect of this was the proposed 72 production airframes that would have been built to fly off the carriers were also abandoned. Only 26 Su-33s were built, and the Varyag carrier was sold to China.

An Uncertain Future…

The Russian Navy's sole shipboard fighter unit the 279th Independent Ship-borne Fighter Aviation Regiment (OKIAP), of the Northern Fleet at Severomorsk-3 Air Base. Apart from Flanker-Ds, the unit operates shore-based Su-27UB trainers and Su-25UTG shipboard trainers. The oldest of these single-seat training aircraft is more than 20 years old.

Pilots regularly deploy to the Nitka training complex at Novofyodorovka Air Base, where the pilots can practice simulated carrier approaches and landings. The base has a simulated steel-plated flight deck complete with four-wire arrestor gear. At the front of the steel deck is a ski jump identical to the one of the Admiral Kuznetsov.

Unfortunately the Nitka training complex was located in Ukraine, and as the Soviet Union collapsed the training site fell into disrepair, so leaving the Russian Navy without a CTOL training facility. However, an inter-government agreement in 1997, allowed Russia to rent the base, that was now owned by Ukraine, for up to 60 days annually, allowing the pilots of the 279th OKIAP to retain their skills.

But, this facility was the focus of attention during the Crimean Crisis in 2014, which resulted in the Russian Spetsnaz being deployed to secure the area as Russian aircraft deployed shock troops to the base.

Prior to this the Russian Navy pilots had already stopped using the site a few months earlier due to logistical reasons, and that Ukraine was offering the training facilities, paid for by Russia, to China and India to use for training their pilots. This was the subject of heated debate politically between the two nations prior to the start of the crisis.

Russia now has its own Nitka complex in Yeysk, near the Sea of Azov, which it began to convert in 2013, with the first pilot training took place in July. Larger and with more facilities the site was completed in 2016, although improvement to the site continue to this day.

Sea Flanker Finale?

Despite the investment in the new facilities the future of the Su-33s remain uncertain. The aircraft have yet to see combat, but find themselves regularly deployed to air defence units in the Kola Arctic to serve along side air force examples. The undisclosed number of Su-33s deployed in the region means that the Northern Fleet ships lack any carrier-based air cover at present other than helicopters.

The latest three-tone blue camouflage gave the Sea Flanker an extremely elegant look, not seen on their air force counterparts. The 279th OKIAP Squadron One badge, a large eagle, is worn on the starboard tail fin. Of note is the simulated carrier deck layout on the airfield's hardstand below the aircraft.

At present the Russian Navy has a reported 21 Su-33s serving with 279th OKIAP of the Northern Fleet at Severomorsk-3 air base, a third of the fighters are no longer airworthy.

In 2009 the Navy announced an order for 24 MiG-29K to replace the Su-33, but in 2015, Major-General Igor Kozhin, Commander of the Navy's Air and Air Defence, stated that second fighter regiment would be formed to augment the current Flanker squadron. Western analysts have observed that the senior Russian Navy officers favour the Fulcrum design over the Flanker for carrier ops, despite its shorter range. As to where this leaves the current force of Su-33s is open to debate. The aircraft have been subject to repairs and modest upgrades as pilots struggle to retain their carrier landing qualifications. For the time being the Su-33s are serving as land-based fighters, while Sukhoi has proposed a number of major improvements and upgraded variants – to date they remain simply as technical proposals. If and when the 'new invigorated' Russian military finally gets its carrier fleet it may be too late for the elderly Su-33s to return to the carrier decks. ■

Role-reversal – much like the Russian's shadowing a US Navy carrier battle group during the Cold War, here HMS Dragon, a destroyer from the Royal Navy shadows the Admiral Kuznetsov during its routine air operations. Both sides would observe strict protocols to ensure that the other cannot misinterpret any moves during these tense intelligence- gathering periods.

HASEGAWA

http://www.hasegawa-model.co.jp

1:72 1/72 KAWANISHI H8K2 TYPE 2 FLYING BOAT MODEL 12 “EMILY”

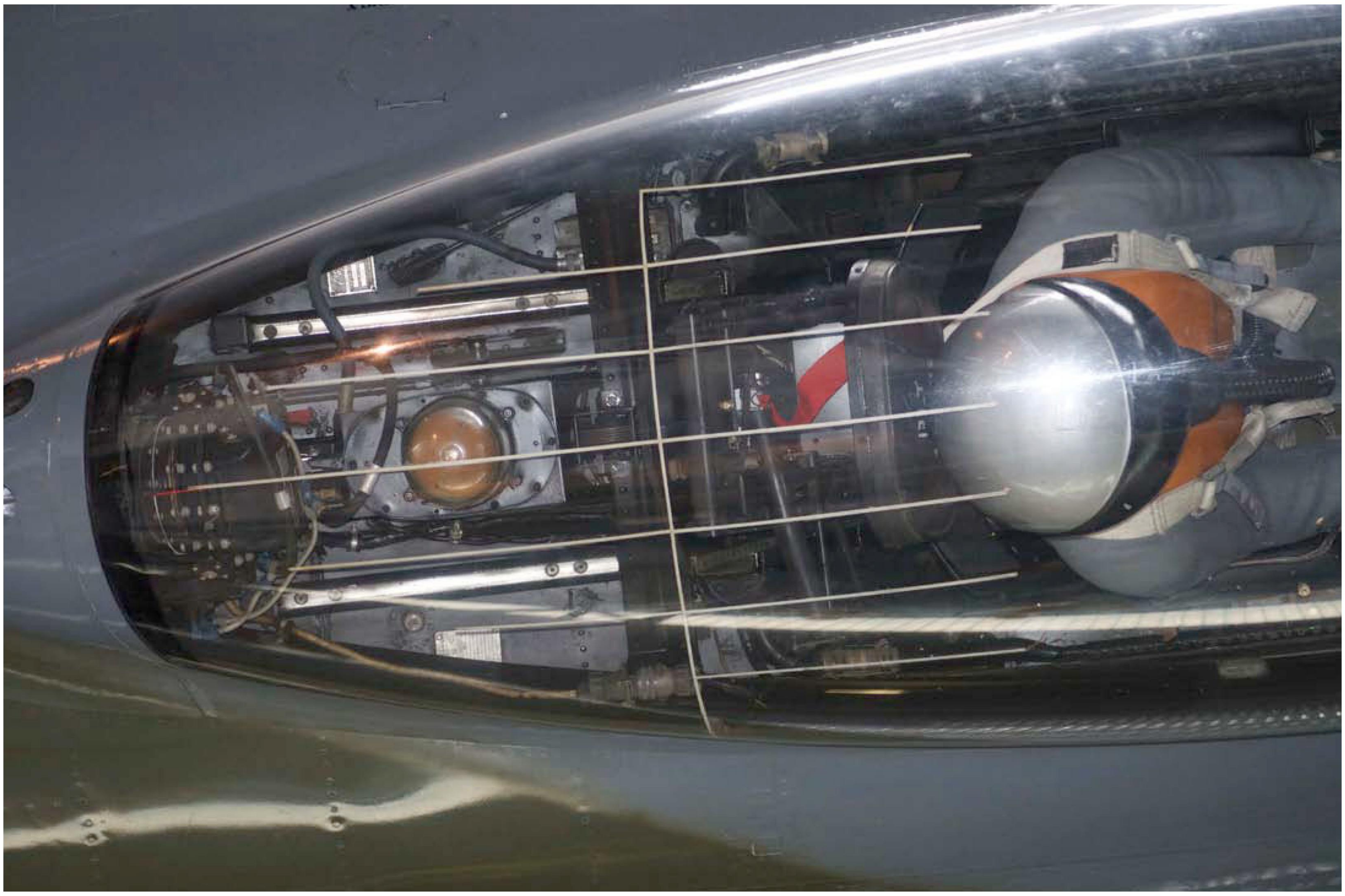
This item is an all-new injection-plastic aircraft model kit, finally replacing Hasegawa’s 1972 Emily! Hasegawa has designed this kit using the latest in digital technology to ensure accurate detail inside and out. The model will feature fine detailing, a fully appointed interior and delicately incised panel lines. There is no news yet on possible colour schemes or unit markings. A photo-etched detail kit to add even more realism to your build, will be available as well.
More news when we get it…

REFERENCE FEATURE

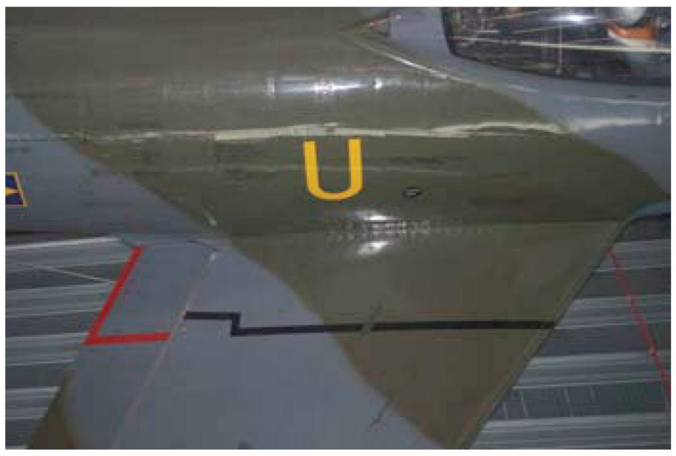
SABRE F.4 IN DETAIL

We take a quick look at Cosford's well-preserved aircraft for those keen to build this aircraft in miniature.
Written by Spencer Pollard

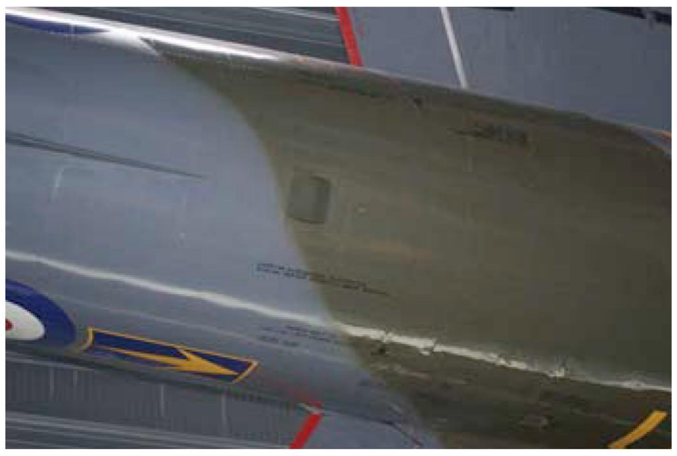
The RAF Museum's Sabre F.4 is a beautifully restored example of this stunning Post-War jet.



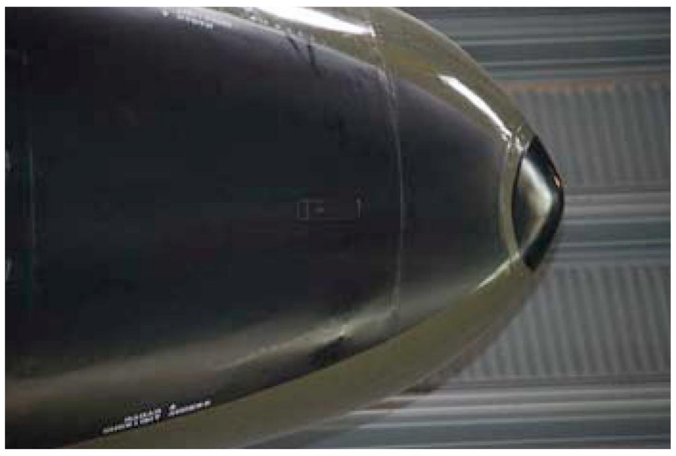
The radar loop antenna can be seen under the large bubble canopy.



With the light bouncing off its surface, the rivets that form part of this aircraft can easily be seen.

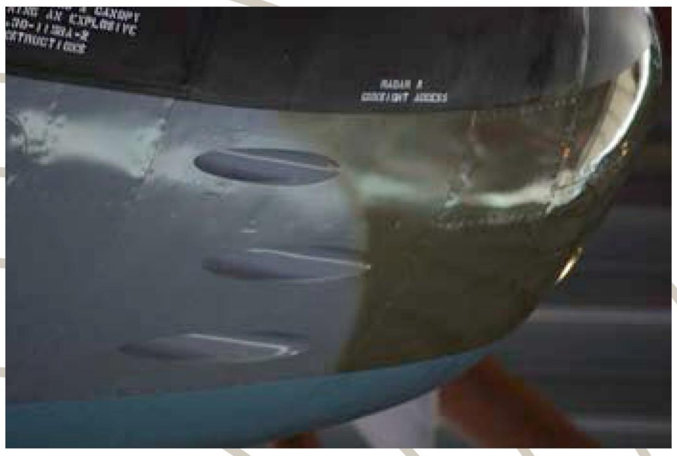


The vent that is found on the upper spine is not surrounded by the raised plate seen on North American built aircraft, all Canadair Sabres being smooth in this area.



The tip of the nose reveals the cover for the AN/APG 30 radar.

Our F.4's 93 Squadron markings are bright and attractive.



The openings for the aircraft's 0.5 Inch guns show off for the camera.

Tail feathers!

REFERENCE FEATURE

VICTOR IN DETAIL

Bruntingthorpe offers the chance to see a real V-Bomber in action. Let's take a look… Written by Spencer Pollard

In the UK we are fortunate to be able to see a number of Victors in various museums so adding detailing to any of the extant kits and the one that will soon be hitting the model shop shelves, is fairly easy. Perhaps the most impressive of these privately owned aircraft is Victor XM715 "Teasin Tina", one of only two surviving Handley Page Victor K2 Tankers that is in serviceable condition and capable of taxiing at full speed. This aircraft is part of the Cold War Jets Collection at Bruntingthorpe Aerodrome. The aircraft is maintained with the support of experienced volunteers who work on or around the aircraft so that it's kept operational for full power taxi runs along the main runway.

Over the next few pages we'll take a look at this amazing aircraft in a little more detail. ■

The low-slung nose is obvious in this shot, as is the sharp demarcation between the upper surface Hemp and lower surface Light Aircraft Grey camouflage.

Ground crew prepare XM715 for her run at one of this year's Cold War Jets open days.

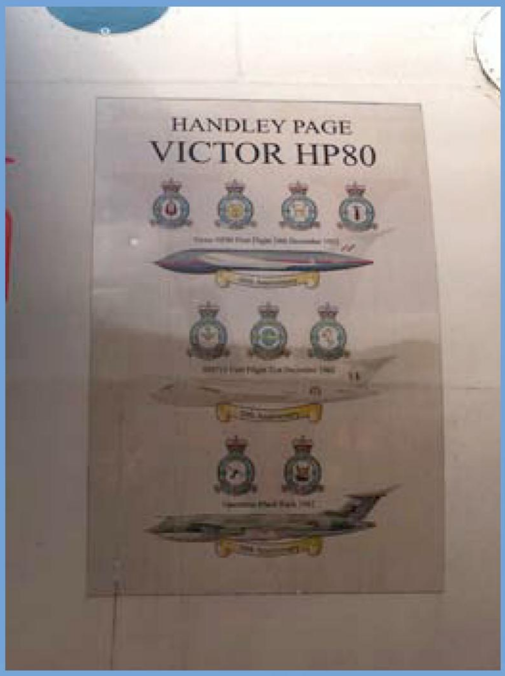
"MELDREW" artwork adorns the starboard nose. Note the demarcation between the camouflage colours and the delicate weathering.

Tail feathers. The massive airbrakes can easily be seen in this shot.

In detail "MELDREW" shows off for the camera.

Sat low on her undercarriage, the Victor is an incredibly futuristic design…

A squadron crest and aircraft serial number decorate the nose gear door.



This commemorative marking can be found on the port side of the nose of XM715.

55 Squadron's badge adorns the tail of our Victor - the last squadron to operate this aircraft prior to its retirement in 1993.

Moving towards the camera, "Teasin Tina" comes into view…

Along with those enormous underwing fuel tanks, the K.2 also carries a refuelling pod under each wing.

Through the heat haze of those powerful Conway engines, the curve of the wings can be seen, as can the large trailing edge flaps.

"Teasin Tina" in all her glory!

The crew access door is a distinct feature, amongst many distinctive features on this aircraft!

H-21C Shawnee “Flying Banana”
No 2733 model kit
modèle réduit
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èchelle
Super Decals Sheet
for 3 versions
2
1
Colores Intructio Sheet
and Photo-Etched included
100% NEW MOULDS
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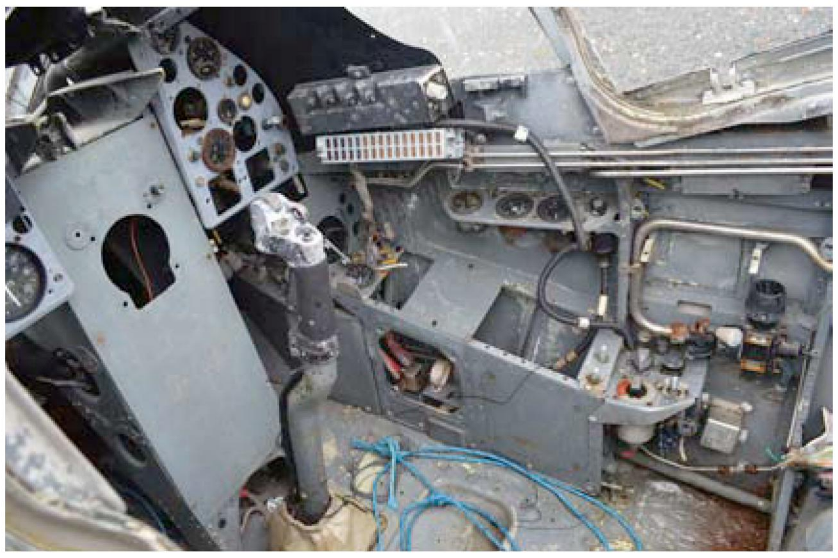
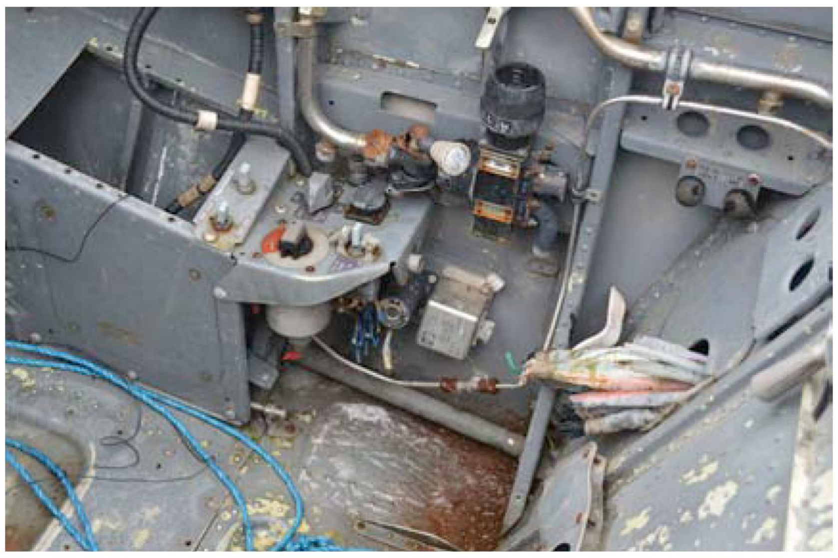
WITTEN AND PHOTOGRAPHED BY SPENCER POLLARD

THE JET AGE MUSEUM'S HARRIER NOSE...

We take a trip to Gloucester to examine what's left of this unfortunate airframe!

When I decided to build a Harrier T.2/4 in 1:24 the first step was to grab as many pictures as I could, collate drawings and then try and plan a way of actually building and painting this large and involved model. Whilst in the process of doing that, I came across an image of a rather sorry looking nose section from a Harrier T.2, further investigation revealing that this piece was owned and displayed by the Jet Age Museum in Gloucester. Knowing that my wife and I were due to take a trip to the Cotswolds to meet friends, I decided to take a detour one rainy Saturday morning to see if I could photograph the nose and hopefully, gain a sense of how the cockpit ►





◀ was constructed.

Arriving at the museum, I could see the nose sat between a number of complete Meteors, so that was a start. Asking the museum staff if I could take some pictures, I was initially greeted with the news that I would not be able to take the pictures, because of its position and health and safety concerns, which was fair enough. After a lengthy chat, the staff agreed that it would be okay (after I'd convinced them that I was who I said I was!) as long as I was accompanied by one of the restoration team. As it turned out, the staff could not have been more helpful and over the next hour I happily chatted with my companion about the museum, as I took over 100 pictures of every square inch of their exhibit.

The Jet Age Museum's Harrier nose is actually in a pretty sorry state! It originally belonged to a Harrier T2 XW264, construction number 212003, that first flew on the 3rd of October 1969. On its delivery flight to A&AEE XW264 experienced a technical failure and flew into ground after loss of control near Boscombe Down and was written off on the 11th of July 1970 - hardly a long and glorious career! Further reading revealed that the aircraft made a forced landing at Boscombe Down, Wiltshire after engine failure due to dirt in the fuel system. The undercarriage collapsed on touchdown and the aircraft skidded on to the runway and burst into flames. The pilot escaped with minor injuries. The remains were then sent

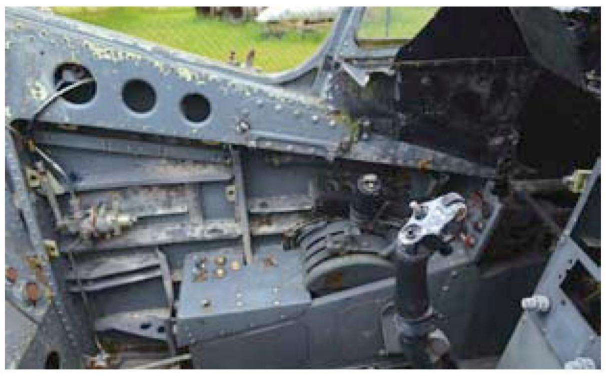
to Dunsfold and later to Farnborough dump before the nose was obtained by the Museum.

Over the years the cockpit has been stripped and all of the expensive, useful items grabbed for spares, no doubt to be used of the extant Harrier fleet operating at the time and during the following years. Still, it serves its purpose well and in places, thanks to the missing parts, gives a good idea of structures that perhaps would have been covered over if the cockpit had been fully fitted out.

But that's perhaps not the end of the story for our Harrier - at least not all of it. Here's some information that I found about the Rolls-Royce Pegasus engine test rig that is now on display at The Helicopter Museum, Weston Super Mare. I've quoted directly from their website www.hmfriends.org.uk

"An experimental Harrier Jump Jet airframe, used by Rolls-Royce in the 1980s to test a modified engine for a potential supersonic version, has become the first fixed-wing aeroplane to join the vertical flight collection at The Helicopter Museum. Previously displayed by the Bristol Aero Collection and Rolls-Royce Heritage Trust at Kemble (left) in Gloucestershire, the Harrier arrived at The Museum, by road, late on 31st October 2012 (above) and will be stored until it can be re-assembled to go on permanent display at the Weston attraction.

The test rig used a much modified airframe with the nose and tail of one Harrier (XV798) and the wings of another (XW264), married to a specially-built centre section to house a vectored-thrust http://www.hmfriends.org.ukRolls-Royce Pegasus engine, modified with plenum chamber burning (PCB). A form of reheat, whereby fuel is mixed with unburnt oxygen in the engine exhaust to provide a ramjet effect, PCB can double the engine thrust but also results in much higher exhaust temperatures."



So it would seem that other pieces from our downed Harrier were used elsewhere; maybe it wasn't such a wasted career, after all! To see that the nose ended up in Gloucester and the wings formed part of the test rig is interesting and for a fan of the aircraft such as me, rather pleasing! I wonder what happened to the rest of it?

Over the next few pages you'll find some detailed shots of the nose that is on display at the museum. I've resisted the temptation to caption them as most of the details are self-explanatory and serve only as a guide to what is needed should you wish to build this aircraft - you will need plenty of shots of a complete aircraft should you wish to add a full set of actual detail.

I would like to once again thank the museum for access to their exhibit and the courtesy they showed me on the day. ■

SPITFIRE MK.IX STILL GOING STRONG!

We take a look at some of the wonderful Spitfires that enthusiasts can still see in the skies over the UK

Written and photographed by Alan Firbank

ZD-B at Old Warden in August 2011. The shows at Old Warden are ideal for capturing top shots of the display aircraft as they fly along the curved display line.

A warm day and working hard in the cockpit, MH434's pilot gets a breath of air by flying with the canopy open.

The Old Flying Machine Company's fine Spitfire Mk.IX is a regular performer at air shows and has starred in several films and television programmes. Here it is being put through its paces at an Old Warden show in August 2011.

◀ The engine of MK 356, the Battle of Britain Memorial Flight's Spitfire LF Mk.IXe was proving difficult to start at Kemble in June 2010. It is not often that we get to see what it under 'the bonnet'.

Eduard's UF-Q depicts and earlier LF Spitfire M.IX with the rounded tail top. Both the markings in the kit and the markings on this BBMF LF Mk.IXe are aircraft belonging to No. 601 (City of London) Squadron. At this time, No. 601 was flying operations from Sicily and Malta with some of their aircraft in this finish.

The aircraft is seen at Duxford in May 2010 on one of its first outings in the overall aluminium finish, apart from the canopy hood in Dark Green. Parked Spitfires often have their elevators dropped and flaps up. ▶

UF-Q at Kemble in June 2010. Note the clean condition in which the aircraft is kept with only slight staining aft of the exhausts.

Another LF Mk.IXe (PL344) taking off from Duxford in July 2010. This one is in the standard camouflage scheme of Dark Green, Ocean Grey and Medium Sea Grey with a set of D-Day stripes.

MH434 performing a fast flyby on arrival at Old Warden in August 2011. The aircraft can be seen at Duxford where it is based with the Old Flying Machine Company's collection.

MH434 inches off the grass at Old Warden following a stunning display. Note the dropped flaps that will be tucked away as the aircraft rolls out.

MH434 shutting down following its display at Old Warden in August 2011.

A massed Spitfire take off at Duxford is a thrilling sight to see. Here, a pair of Mk.IXs departs Duxford for a display at Flying Legends in July 2010.

FINAL THOUGHTS

INSPIRATION: IT ONLY NEEDS ONE PICTURE...

As a model maker, I am more often than not more inspired by real subjects than models that I see of them. Though I've seen plenty of builds of the incredible Lightning, the chance to see three of them earlier this year in Bruntingthorpe was enough to have me running to my collection of kits in order to finally build one in miniature.

So I thought that this month I would round up this issue with a simple picture that I took at the event, of the Lightning Preservation Group's Lightning F.3 XR713, the last complete and uncut Lightning F.3 airframe in existence. She was 111 Squadron's mascot airframe and gateguard for many years at RAF Leuchars and as such, was well-kept and cared for. With the closure of RAF Leuchars', the aircraft was due to be disposed of and thanks to a fund raising effort by the Lightning Preservation Group was bought and transported to Bruntingthorpe. Thankfully, the aircraft had not been previously cut for transport and so was dismantled correctly and beautifully rebuilt at Bruntingthorpe, where she now joins the two running F.6s.

Now, where's that kit..? ■

Airbus A321-231SL msn 5546 of Turkish Airlines was delivered new to the airlines base at Istanbul Ataturk airport in January 2014 and named 'Van' is seen departing Dusseldorf, Germany in March 2015. The aircraft is sports Airbus' 'Sharklet' winglet system and is powered by the IAE V2533-A5 option.

WRITTEN AND PHOTOGRAPHED BY MARCUS JELLYMAN

THE AIRBUS INDUSTRIES A321

As the hugely successful A320 went into service in 1988, and with commitments for 1983 aircraft from 10 customers, the designers at Airbus were already putting pencils to paper, designing the first of what would be four derivatives of the A320. The new A321 would be a stretched version of the standard A320 with a fuselage extension totalling 6.94 metres (22ft 9 in). Four plugs, two in front of the wing at 4.27 metres (14ft 0 in) and two aft at 2.67 metres (8ft 9 in), would be inserted to achieve the new length of 44.51 metres. Other modifications were an increased wing area and double slotted flaps to maintain performance.

The maiden flight of the aircraft (F-WWIA) took place on the 11th of March 1993 and deliveries began to the two launch customers Germanys Lufthansa and Italy's Alitalia just under a year later in January and March 1994 respectively. Like the A320, the A321 would be offered with a choice of engines that included the International Aero Engine (IAE) V2500, which powered prototype aircraft No.1, and the CFM56-5B which powered prototype No.2. However the basic A321-100s would have a reduced range compared to the A320 due the fact that extra fuel tanks were omitted because of extra weight penalties. To overcome this, Airbus soon launched the '200' series which would benefit from higher thrust engines, increased maximum take-off weight and additional fuel tanks for greater range. The '200' first flew in December of 1996 with the first aircraft entering service with the UK airline Monarch in April 1997.

Built in Hamburg, Germany, the A321 would be the first Airbus to be built outside of France, and following the A321, the A319 and A318 would also be built there. As of the end of September 2016, nearly 1400 A321s had been delivered with around 350 still to be delivered.

The Airbus A321neo (New Engine Option)

In 2006 Airbus began research and development into improvements to the A320 family. They included improvements to the aerodynamics, engines and cabin. The most noticeable of these was the addition of large winglets (Airbus name Sharklets). These modifications would increase either payload of the aircraft or add an additional 100 nautical miles range. Known as the A320ceo (Current engine option) deliveries of these aircraft began in December of 2012. The future for the A320 is the NEO (New engine option). Two brand new engines options have been developed, and with new interior layout, will provide airlines with a further 20 per cent improvement in fuel consumption and an extra 500 nautical miles range. The first aircraft flew in September 2014 and deliveries began at the end of 2015.

The Airbus A321neo first took to the air in February 2016, but suffered ►

Airbus A321-211 msn 0970 in the colours of German carrier, Germania. Delivered to Sabena, the national airline of Belgium in February 1999 she flew with them until their bankruptcy in 2001. The aircraft then flew in Tunisia until joining Germania in May 2014. Photographed leaving Dusseldorf in March 2015, and has the CFMI CFM56-5B engines powering it.

a tail strike soon after, requiring a few weeks of repairs causing several weeks of delays to the certification programme. The airframe shares over 95% of the parts of the current A321, but improvements with composites and alloys and a reconfiguration of the cabin that will optimise cabin space, the 'neo' is quickly becoming the leader in its market. Aiding the A321neo success is Boeing stop producing the B757 which would have been a direct competitor the A321neo, and their replacement, the B737-900MAX is basically an update of a 1960's design. Airbus have further enhanced the aircraft with the A321LR, a new

Airbus A321-231 msn 2536 of British Airways is seen departing Dusseldorf on a return flight to its base at London Heathrow. Delivered new to the airline in August 2005 and uses the IAE V2533-A5 engine.

Airbus A321-232 msn 3462 of Greek Airline, Aegean. Based at Athens' International Airport since delivery in 2008, the aircraft is seen departing London Stansted for the Greek capital.

Airbus A321-211 msn 2117 of KTHY Cyprus Turkish Airlines is seen arriving at London Stansted on a summers evening in August 2008. Delivered new in 2004 and flew with the airline until their failure in 2010, she now flies with Ural Airlines of Russia.

Airbus A321-211 msn 0684 of CSA Czech Airlines is seen departing London Stansted on the 20th December 2008 for Prague. Originally delivered to Air France in June 1997, the aircraft has had a number of operators and currently flies with Germania based in Munich.

Airbus A321-232 msn 2730 is seen in the striking colour scheme of Royal Jordanian Airlines on approach to London Heathrow's runway 27 Left on the 6th November 2007. The aircraft now flies with Monarch Airlines based at Luton.

The IAE V2500 was offered soon after the CFM International engine and it different in appearance to the CFM. It is a collaboration of several large aero engine manufacturers including, Rolls Royce and Pratt & Whitney.

CFM's 56-5B engine powered the first of the A320 family of aircraft and is a joint venture between Safran Aircraft Engines (Formerly SNECMA), France and General Electric of the US. There are currently 10,000 of these engines powering Airbus' around the world.

variant of Airbus' A321neo, deliveries of which will begin in 2019, and will have the longest range of any single-aisle jetliner, able to fly routes of up to 4,000 nm. It is ideally suited to transatlantic routes, and enables airlines to tap into new long-haul markets that were not previously accessible with current single-aisle aircraft.

To date 1,310 A321neos have been ordered by the world's airlines giving the aircraft a significant share of the market in its class. ■

Airbus A321-211 msn 2270 in the classic colours of the national airline of Spain, Iberia. Delivered new to the airlines in late 2004 and named 'Palmeral De Elche'. She is seen here taxiing for departure from its base at Madris Barajas on a bitterly cold day in December 2008.

Airbus A321-211 msn 1994 in the great colour scheme of German tour operator LTU International Airways is seen taxiing for departure from Madrid Barajas on the 15th May 2007. Following their takeover of LTU, the aircraft retains the same registration but flies in the colours of Air Berlin.

Smoke Winders on the wing-tip pylons help show off a spirited routine by the French Air Force Rafale C at RIAT 2016.

WRITTEN AND PHOTOGRAPHED BY ALAN FIRBANK

IN COLOUR!

We take a look at the wonderful Rafale

A French Air Force Rafale C performs a lovely top-side pass at RIAT 2016.

The Rafale C take a bow at the end of its display at RIAT 2013.

The two seat Rafale B appears only rarely at air shows in the UK. This one is at the RNAS Yeovilton Air Day in July 2009.

A specially marked Rafale C at RIAT 2013 celebrated 30,000 flying hours.

A great underside view of the Rafale C at RIAT Fairford, July 2016. Note the different grey shades on the panels.

We don't see the French Navy Rafale M very often at UK shows. This one performs at RNAS Yeovilton's Air Show in 2011.

The French Air Force Rafale C departs RIAT 2016 at the end of the show.

The French Air Force Rafale C makes a high-g turn into its display at RIAT in July 2013.

Canopy open on a warm July day, the Rafale C arrives for the 2013 RIAT.

A dull arrivals day at Florennes in June 2016 sees the arrival of a French Rafale C for the Belgian Air Force's Show Weekend.

Belgium for the 2016 show.

A Rafale C in special markings does not often appear in the UK. This pass by the Rafale marking 30,000 Hours came to Fairford in 2013.

Back on the runway, the 30,000 Hour Rafale C at Fairford in 2013.

The French Air Force Rafale C's pilot waves to the farmer's field spectators when arriving at Fairford for RIAT 2013.

French gallantry turns into French embarrassment when the Rafale's nose wheel steering locks at ninety degrees on Fairford's runway during the 2013 show.

FINAL THOUGHTS

ROCKWELL X-31 – A PERFECT SCRATCHBUILT PROJECT?

The Rockwell-Messerschmitt-Bölkow-Blohm X-31 Enhanced Fighter Manoeuvrability program was designed to test fighter thrust vectoring technology. Thrust vectoring provides additional control authority in pitch and yaw, resulting in significantly more manoeuvrability than most conventional fighters. An advanced flight control system provides controlled flight at high angles of attack where conventional aircraft would stall or lose control.

The X-31 design was essentially an all-new air-frame design, although it borrowed heavily on design elements and sometimes actual parts of previous production, prototype, and conceptual aircraft designs, including: the Experimental Airplane Program (choice of wing type with canards, plus underfuselage intake), and the German TKF-90 (wing planform concepts and underfuselage intake), F/A-18 (forebody, including cockpit, ejection seat, and canopy; electrical generators), F-16 (landing gear, fuel pump, rudder pedals, nosewheel tires, and emergency power unit), F-16XL (leading-edge flap drives), V-22 (control surface actuators), Cessna Citation (main gear's wheels and brakes), F-20 (hydrazine emergency air-start system, later replaced), B-1 (spindles from its control vanes used for the canards). This was done on purpose, so that development time and risk would be reduced by using flight-qualified components.

Given that a lot of this aircraft features off-the-shelf components and having learned a lot from my Harrier conversion, I'm leaning towards tackling tis aircraft as a full scratchbuild, using some spare kits to provide the detailed bits and pieces.

But why, given that there are so many cool kits, would I want to build something from scratch? Simply put, the challenge. Over the years it's been fun to push my skills and see where they will take me. I've made other models from scratch, but never had the confidence to build an aircraft from the ground up. Now, I want to see if I can do that and the X-31 seems to be the perfect choice.

If this model ever sees the light of day, I'll chart its progress and then let you see the results. All I have to do is get the Harrier finished, first! ■

(U.S. Marine Corps photo)